Marine Aquaculture Site Loch Hourn

Appendix 2. Hydrographic Data Reports for deployments ID246, ID253, ID254 & ID275

Mowi Scotland Limited
November 2021

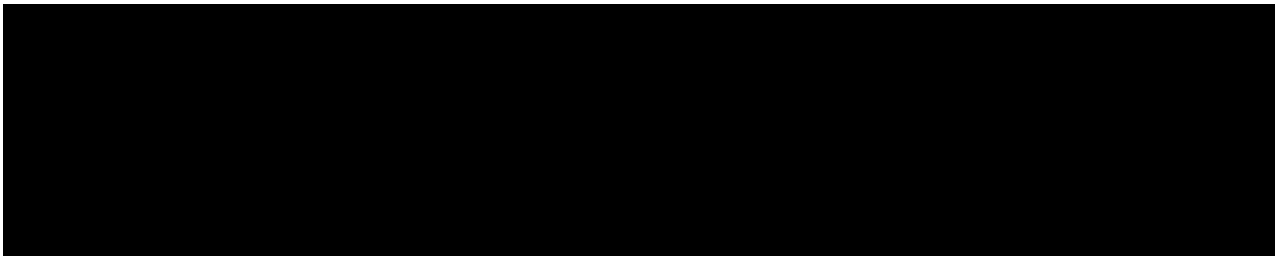
Loch Hourn

Hydrographic Data Report: deployment ID246

11th September to 5th November 2018

May 2021

Mowi Scotland Limited



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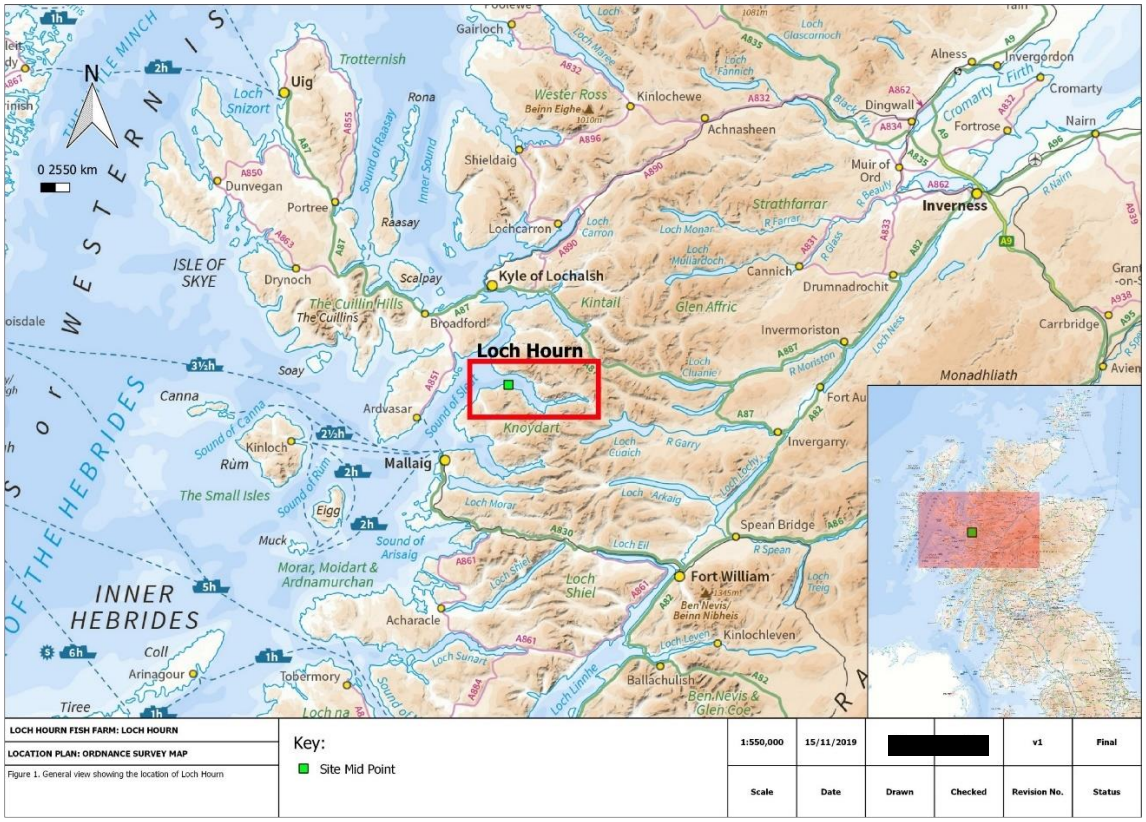
QUALITY ASSURANCE

Mowi Scotland Ltd is ISO9001 and ISO14001 accredited and all project management follows policies designed to ensure that the collection, collation and reporting of information produced in the course of our operations is done to a consistently high standard meeting the requirements of the end user.

1. Introduction



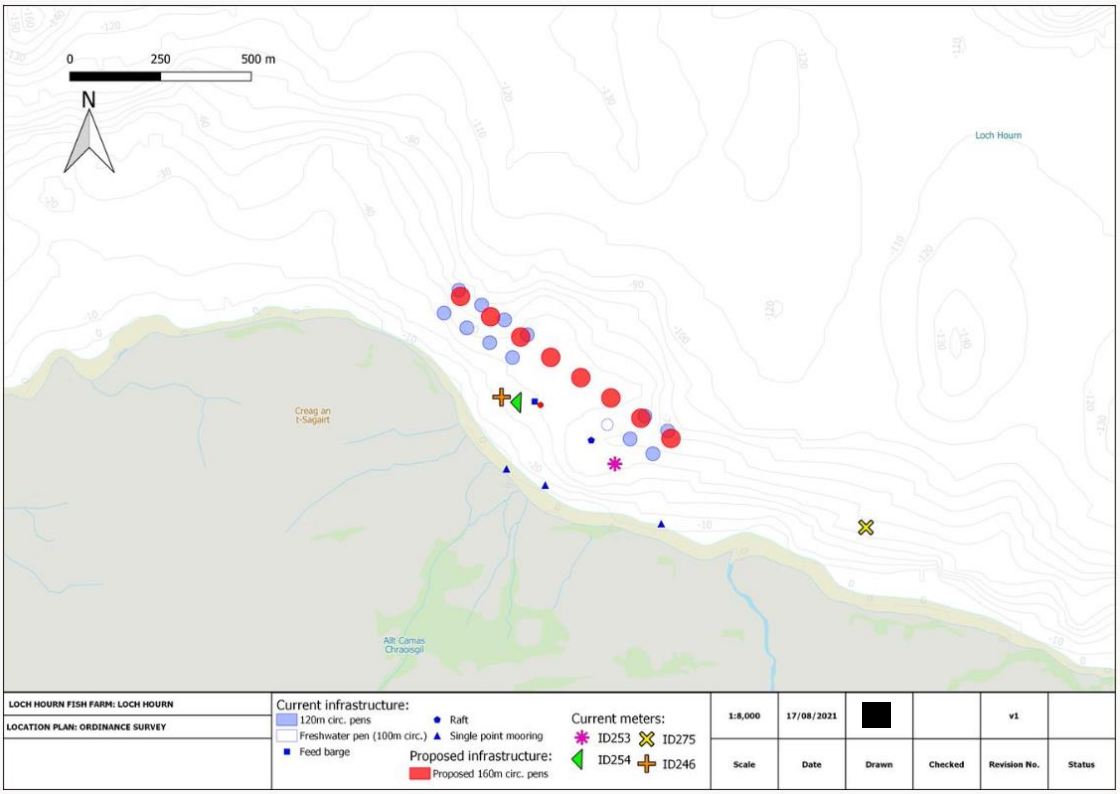


Figure 1. Site location (top) and layout (bottom) and of the salmon farm at Loch Hourn. The current meter deployment locations are marked by the cross, plus, star and triangle.

Mowi Scotland Ltd is preparing an application to the Scottish Environmental Protection Agency (SEPA) for a technical variation to CAR/L/1105276 to modify an existing salmon farm site in Loch Hourn. Mowi Scotland Ltd propose to change the existing site from 12 x 120 m circumference pens, with 16m deep nets, held in a

75m grid (Figure 1) to 8 x 160 m circumference pens with 20m deep nets which will be held in a 100m grid. An increase to the maximum standing biomass, from 2500T to 3100T, will also be applied for.

Mowi Scotland Ltd have carried out hydrographic surveys at the site between 2018 and 2019. Hydrographic data at Loch Hourn was gathered between this period in four deployments:

i. 11th September to 5th November 2018 (ID246)
ii. 29th November to 10th January 2019 (ID253)
iii. 29th November to 11th January 2019 (ID254)
iv. 30th April to 4th July 2019 (ID275)

This report describes the data from the 11th September to 5th November 2018 deployment at Loch Hourn. The purpose of this report is to assess the suitability of the collected hydrographic data for input into a hydrodynamic model of the Loch Hourn region and into the NewDepomod model.

2. Materials & Methods

2.1 Depth Survey

Bathymetry for the study area was supplemented by local area bathymetry surveys, and other data sources e.g. the UKHO INSPIRE bathymetry data (http://aws2.caris.com/ukho/mapViewer/map.action). These data were merged into a single dataset and used to provide water depths in the local area (Figure 2).

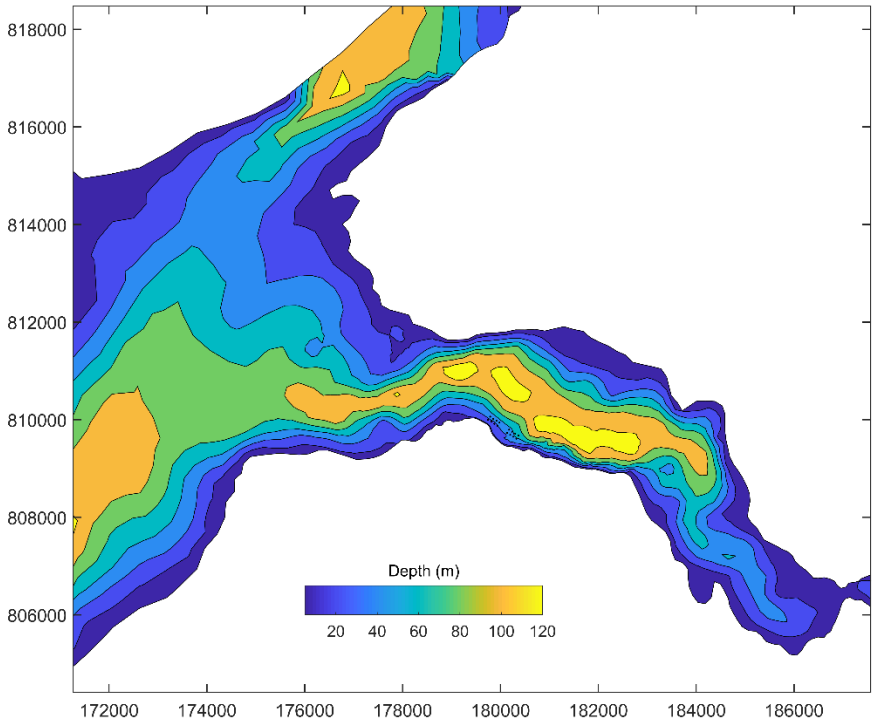


Figure 2. Bathymetry in the region of Loch Hourn.

2.2 Current Data

Mowi staff carried out hydrographic surveys at the site during 2018 – 2019. The purpose of this hydrographic report is to assess the suitability of the collected hydrographic data for use with the NewDepomod model. The data contained in this report were recorded at the site from 11th September to 5th November 2018 (55 days and 10 hours of data; deployment ID246). The data from the other three deployments (ID254, ID253 and

ID275) are presented in separate hydrographic reports**.** In addition to current data, bathymetry data were also collected to support these reports.

The Sentinel V100 (Wide) ADCP (Table 1), within its mooring frame, was positioned at 57° 07.557'N, 005° 38.272'W (179906.96E 809768.88N), which was approximately 126m from the nearest shoreline and approximately 344m from the centre of the proposed cage group (Figure 1). The transducer head was 70 cm from the base of the mooring frame. The mean depth (derived from the pressure sensor) at the Sentinel V100 ADCP position was 34.61 m.

Initial soundings were taken to establish the possible depth the Sentinel V100 ADCP would be situated at during high tide and so that the most appropriate cell size could be determined. The cell size was set at 1.0 m and the number of cells to 69.

Data was automatically written and stored to the internal memory within the Sentinel V100 ADCP main body and then downloaded to computer after completion of the deployment period via WiFi.

2.3 Magnetic Variation

No magnetic variation correction was made to the Sentinel V100 ADCP during deployment, this was undertaken to the data after the instrument was recovered and data downloaded. The magnetic variation used was 3.36°; this was determined using the World Magnetic Model, produced jointly with the US National Oceanographic and Atmospheric Administration's National Geophysical Data center. Further details can be found at http://www.geomag.bgs.ac.uk/navigation.html

2.4 Data Processing

Upon retrieval of the Sentinel V100 ADCP current meter, all data was downloaded to a computer for analysis. The raw data file was opened in Teledyne's "Velocity" software and Matlab. Deployment diagnostic data (beam intensity, correlation, pitch and roll) were analysed to confirm that the deployment was successful with the instrument orientated upright. The heading data were also examined to identify any movement of the Sentinel V100 ADCP mooring frame during the deployment.

The diagnostic data suggested that velocities from the first 25 bins were valid (Figure 3). Calculations were undertaken to identify the cells to be used for surface and middle currents. Surface data was taken at an average depth (derived from the pressure sensor) of 4.30 m (cell 25), and cage-bottom data at 15.30 m (cell 14). Surface and middle cell heights above were 27.72 m and 16.72 m from the seabed respectively. The bottom cell (cell 1) was at a depth of 28.30 m and 3.72 m above the seabed.

Table 1: Sentinel V100 ADCP Specifications.

Depth Cell Size[1]		**V20 (1000kHz)**		**V50 (500kHz)**		**V100 (300kHz)**	
	Depth Cell Size[1]	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow
	0.25m	18.0/22.6	19.2/36.5				
	0.3m	19.3/24.0	11.1/20.8				
	0.5m	20.2/24.9	7.1/13.4	44.1/57.6	19.2/36.5		
	1.0m	22.1/26.9	3.6/6.7	50.5/64.6	7.1/13.5	94.5/120.6	10.9/20.6
	2.0m	24.5/29.4	1.7/3.2	56.0/70.6	3.6/6.7	103.5/130.4	5.5/10.3
	4.0m	26.9/32.0	0.8/1.6	63.1/78.2	1.7/3.2	114.6/142.3	2.7/5.2
	6.0m			67.4/82.8	1.1/2.1	121.7/151.5	1.8/3.3
Communications and Recording	Wireless	802.11b/g/n					
	Internal memory	One 16GB Micro SD Card included					
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity resolution	0.1cm/s					
	Velocity range	±5m/s (default); ±20m/s (maximum)					
	Ping rate	Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyV—Pre-deployment (testing, planning, and data recovery)[5] Velocity—Post-processing (data handling, display, and export)[6]					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case • AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

1 User's choice of depth cell not limited to the typical values specified.
2 Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.
3 User selects the bandwidth mode; wide = 25% or narrow = 6%.
4 Standard deviations (Std Dev) are typical values for single ping data
5 Resident in ADCP accessed via a web browser.
6 Windows™ based software program.

Specifications subject to change without

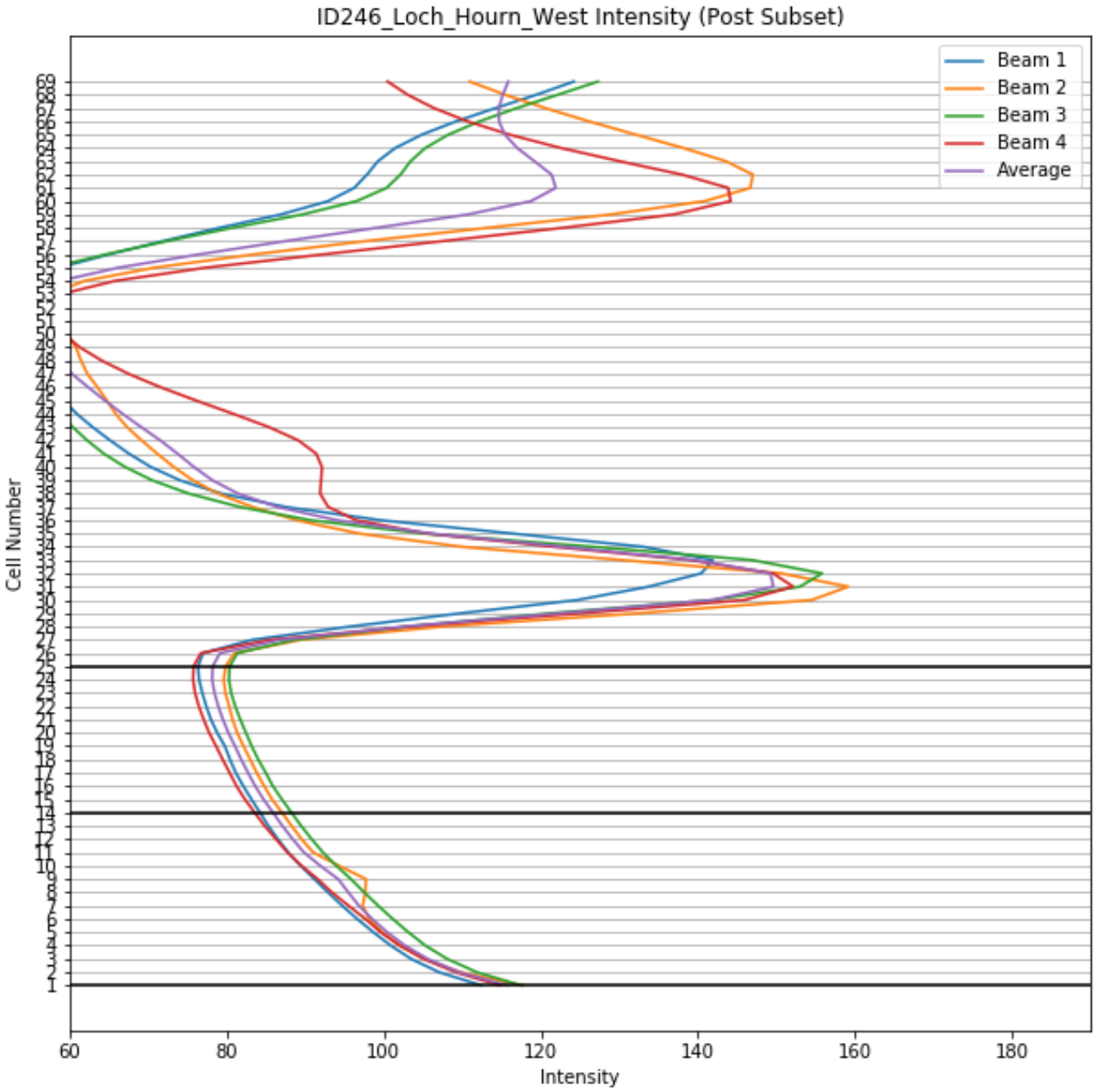


Figure 3. Mean intensity of the ADCP signal for the ID246 dataset plotted by bin number

The 'first cell range' is automatically calculated by the instrument, which is the distance from the transducer head to the first cell. For this deployment, the first cell range was calculated as 3.02 m. This value is then added to the height of the instrument frame (0.7 m) to get the first cell height above the seabed, which equated to 3.72 m.

Standard deviation has been assessed throughout the deployment to identify accurate and reliable data for near bed, middle (net depth) and surface cells using the following equation:

$$Cell\ StdDev = \frac{Instrument\ StdDev}{\sqrt{No.valid\ pings}} \qquad (1)$$

The Instrument Standard Deviation (StdDev) in Equation 1 is determined using the deployment settings when the meter is programmed, examples of the StdDev values for different configurations are shown in Table 1. This deployment had a cell size of 1m which equates to an Instrument StdDev of 10.9 cm/s.

The Percentage of valid pings used to calculate Cell StdDev is derived using "Percentage Good" data which allows us to relate the StdDev to the actual data gathered. The percent good data is available for 1, 2, 3 and 4 beams which represent the following:

- Percent good 1 = % of good data computed from 3 Beams
- Percent good 2 = % of bad data due to more than 2 Beam bad
- Percent good 3 = % of bad data due to error velocity exceeded
- Percent good 4 = % of good data computed from 4 Beams

The method described has been used to calculate the Standard deviation throughout the deployment for the surface, middle and bottom cells; the average StdDev values for the surface middle and bottom was 0.63cm/s, 0.63cm/s and 0.63cm/s respectively which are all within the SEPA criteria of 2cm/s.

2.5 Meteorological Data

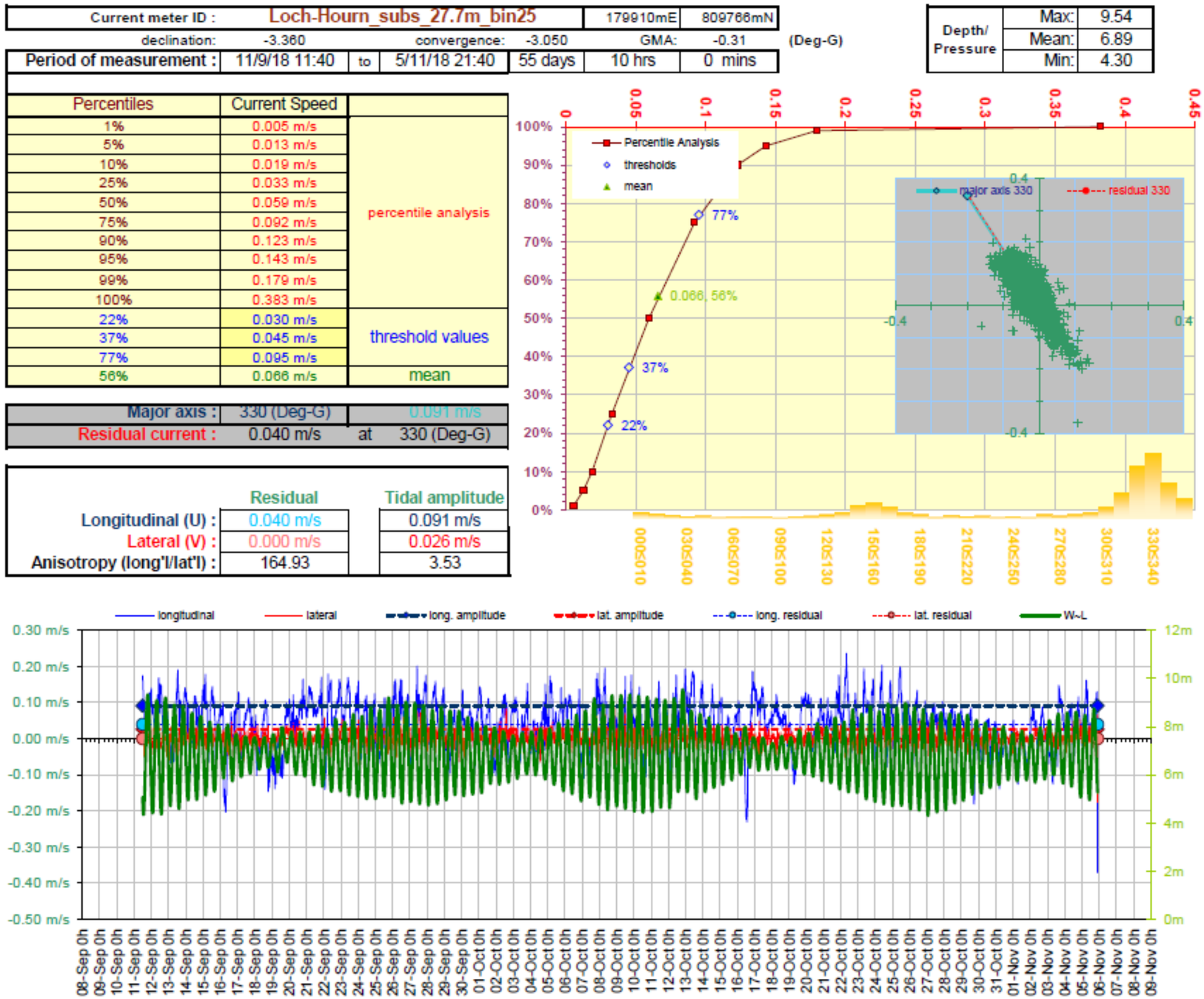
The collection of meteorological data is no longer required to support the assessment process and consequently has not been undertaken. The current data used is collected using mulitple deployments and over a longer period and thus provides a more realistic representation of site conditions than short deployments, thus allowing an assessment of the influence of meterological conditions.

3. Results and Discussion

A summary of the current data is shown in Figure 4 to Figure 11 and in Table 2 to Table 4. Over the period analysed for this report, the near-surface, middle and bottom cells had current speed averages of 6.58 cm/s, 5.28 cm/s and 3.72 cm/s respectively. This gave an overall average of 5.19 cm/s. The orientation of the tidal velocities was northwest, southeast.

Residual currents at the surface and mid-depth were toward the north-west (330°G and 335°G respectively); near the seabed, the residual flows during the deployment period were to the northwest (341°G, Figure 9). The magnitude of the residual currents for the surface, middle and bottom cells were moderate, with mean values of 0.040 m/s, 0.029 m/s and 0.014 m/s respectively.

4. Hydrographic Data Summary Sheets



x	y
major axis 330	
-0.2	0.3464
-0.045	0.0788
0	0
######	######
residual 330	
0	0
-0.02	0.0343
-0.198	0.3476

Figure 4. Current Data Summary Sheet for the surface current cell 25, 27.7m from seabed, 11th September to 5th November 2018 inclusive (ID246).

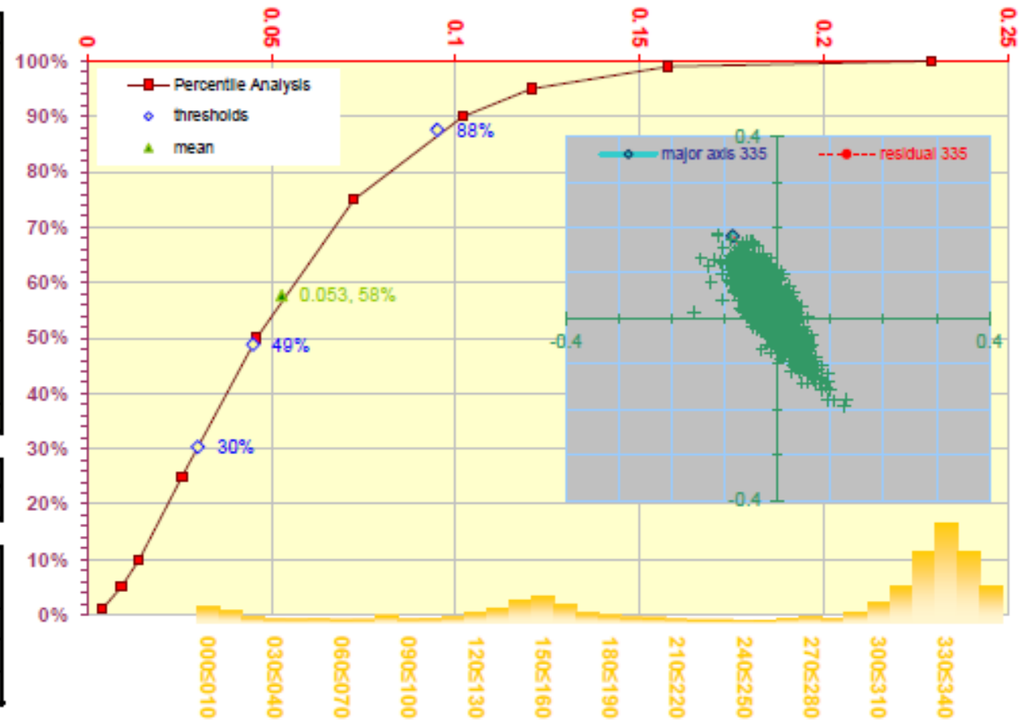
Current meter ID :	Loch-Hourn_cbot_16.7m_bin14				179910mE	809766mN
declination:	-3.360		convergence:	-3.050	GMA:	-0.31 (Deg-G)
Period of measurement :	11/9/18 11:40	to	5/11/18 21:40	55 days	10 hrs	0 mins

Depth/ Pressure		
	Max:	20.54
	Mean:	17.89
	Min:	15.30

Percentiles	Current Speed	
1%	0.004 m/s	percentile analysis
5%	0.009 m/s	
10%	0.014 m/s	
25%	0.026 m/s	
50%	0.046 m/s	
75%	0.072 m/s	
90%	0.102 m/s	
95%	0.121 m/s	
99%	0.158 m/s	
100%	0.229 m/s	
30%	0.030 m/s	threshold values
49%	0.045 m/s	
88%	0.095 m/s	
58%	0.053 m/s	mean

Major axis :	335 (Deg-G)		0.077 m/s
Residual current :	0.029 m/s	at	335 (Deg-G)

	Residual	Tidal amplitude
Longitudinal (U) :	0.029 m/s	0.077 m/s
Lateral (V) :	0.000 m/s	0.022 m/s
Anisotropy (long'l/lat'l) :	356.36	3.46



x	y
major axis 335	
-0.085	0.1813
-0.032	0.0696
0	0
######	######
residual 335	
0	0
-0.012	0.0261
-0.084	0.1815

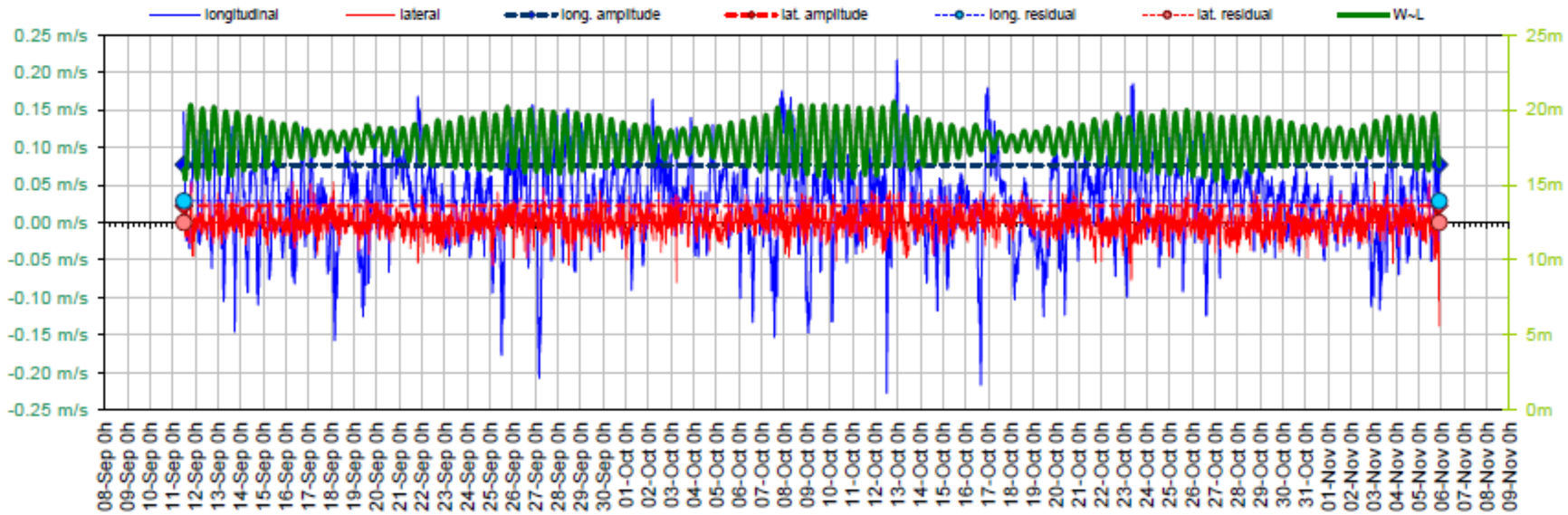


Figure 5. Current Data Summary Sheet for the cage bottom current cell 14, 16.7m from seabed, 11th September to 5th November 2018 inclusive (ID246).

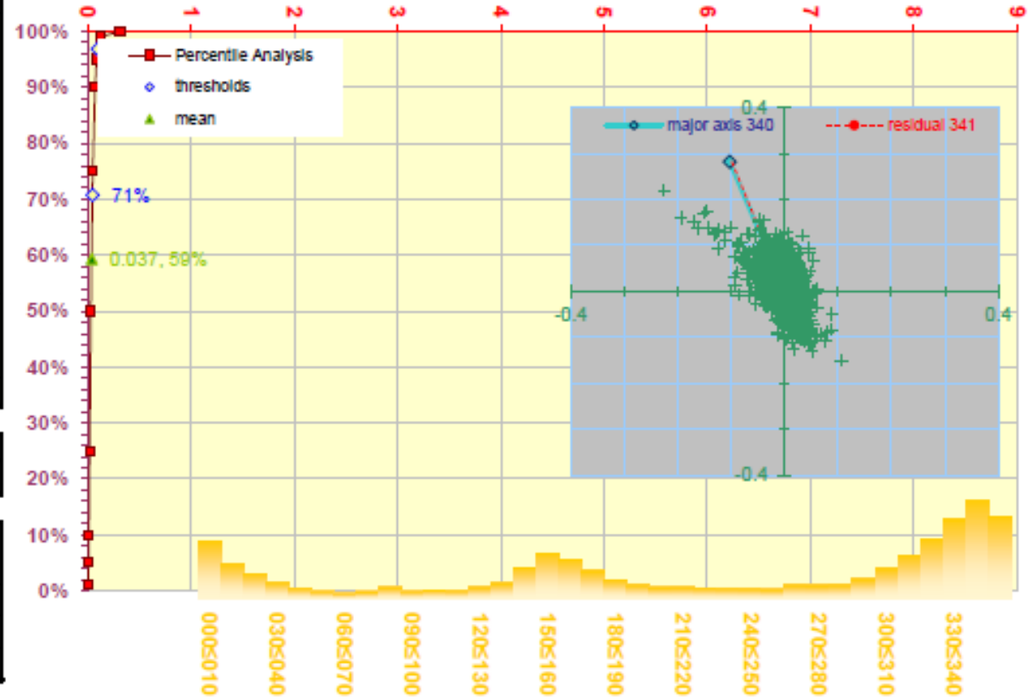
Current meter ID :	Loch-Hourn_nrbd_3.7m_bin01			179910mE	809766mN
declination:	-3.360		convergence: -3.050	GMA:	-0.31 (Deg-G)
Period of measurement :	11/9/18 11:40	to	5/11/18 21:40	55 days	10 hrs 0 mins

Depth/ Pressure	Max:	33.54
	Mean:	30.89
	Min:	28.30

Percentiles	Current Speed	
1%	0.003 m/s	percentile analysis
5%	0.008 m/s	
10%	0.011 m/s	
25%	0.019 m/s	
50%	0.031 m/s	
75%	0.049 m/s	
90%	0.070 m/s	
95%	0.086 m/s	
99%	0.121 m/s	
100%	0.314 m/s	
#N/A	8.000 m/s	threshold values
71%	0.045 m/s	
97%	0.095 m/s	
59%	0.037 m/s	mean

Major axis :	340 (Deg-G)		0.056 m/s
Residual current :	0.014 m/s	at	341 (Deg-G)

	Residual	Tidal amplitude
Longitudinal (U) :	0.014 m/s	0.056 m/s
Lateral (V) :	0.000 m/s	0.024 m/s
Anisotropy (long'l/lat'l) :	82.12	2.33



x	y
major axis 340	
-0.103	0.2819
-0.019	0.0527
0	0
######	######
residual 341	
0	0
-0.005	0.0135
-0.099	0.2831

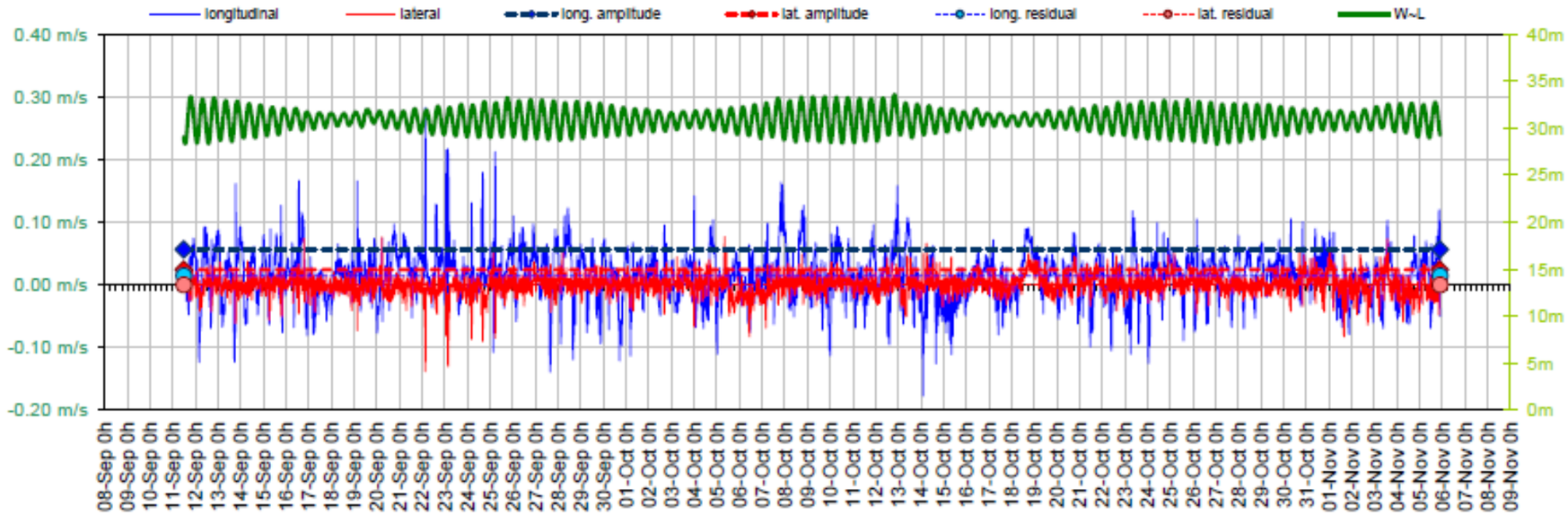


Figure 6. Current Data Summary Sheet for the near bottom current cell 1, 3.7m from seabed, 11th September to 5th November 2018 inclusive (ID246).

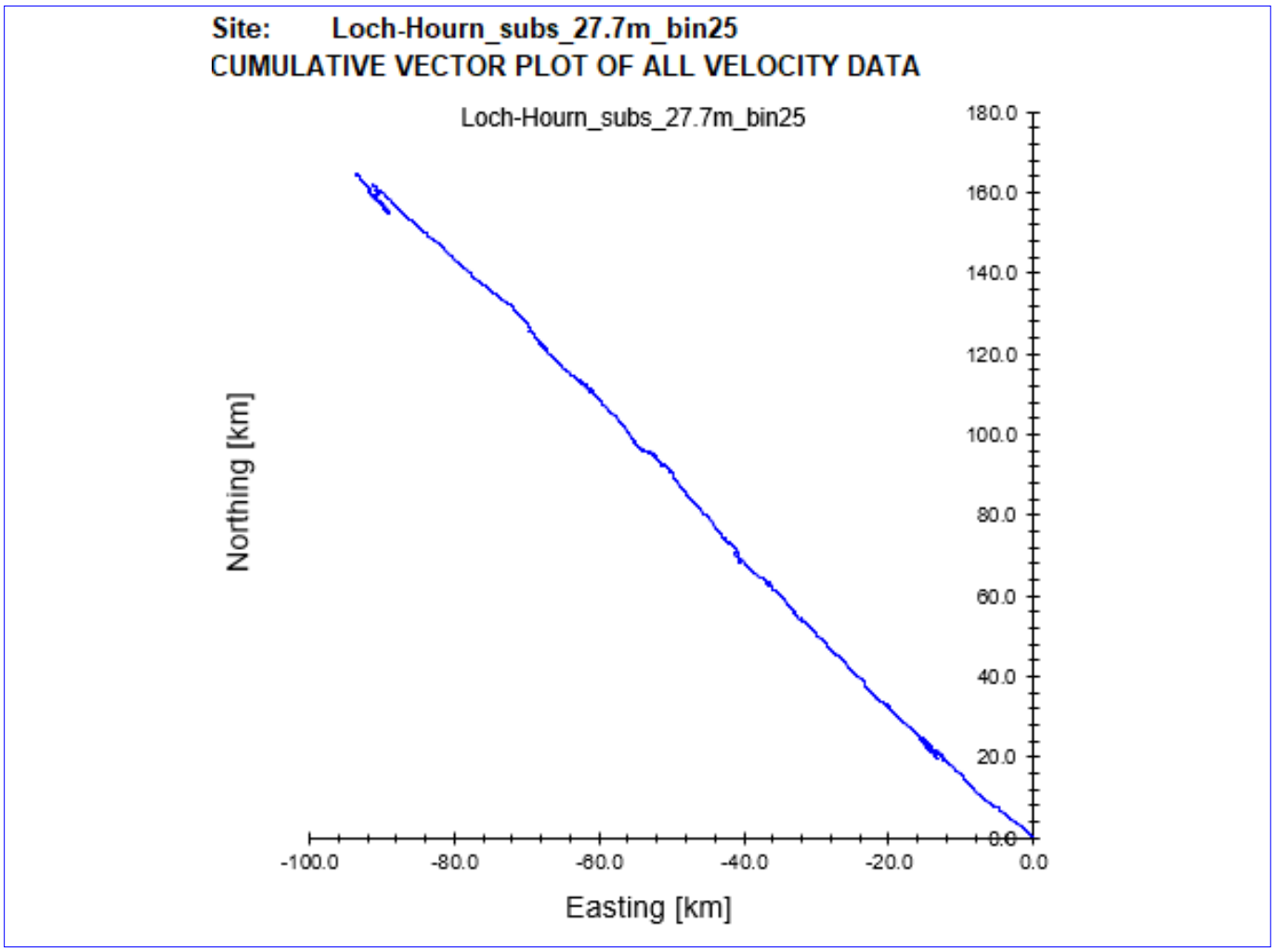


Figure 7. Cumulative Vector Plot of all velocity data from near surface cell for ID246.

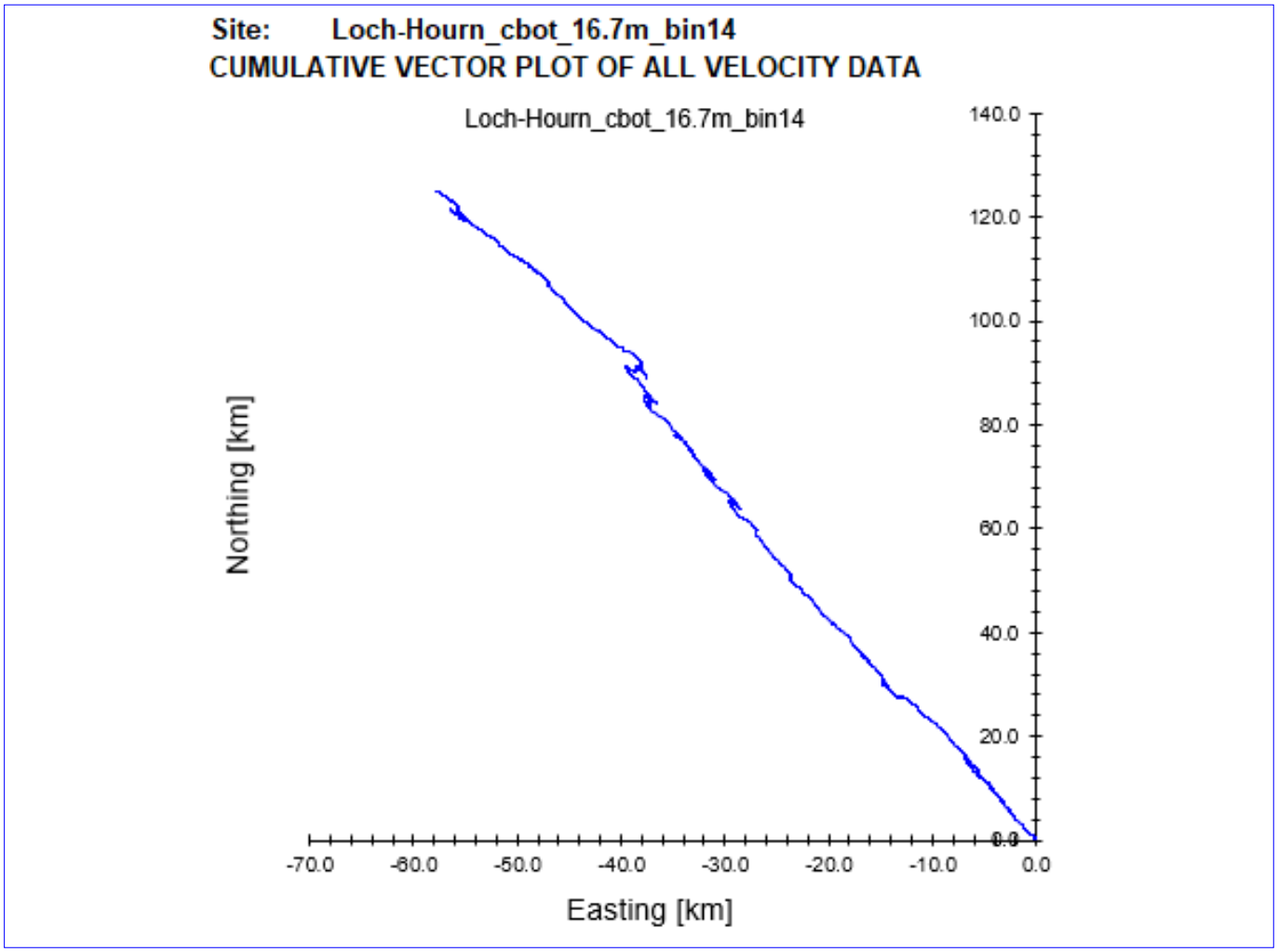


Figure 8. Cumulative Vector Plot of all velocity data from cage bottom cell for ID246.

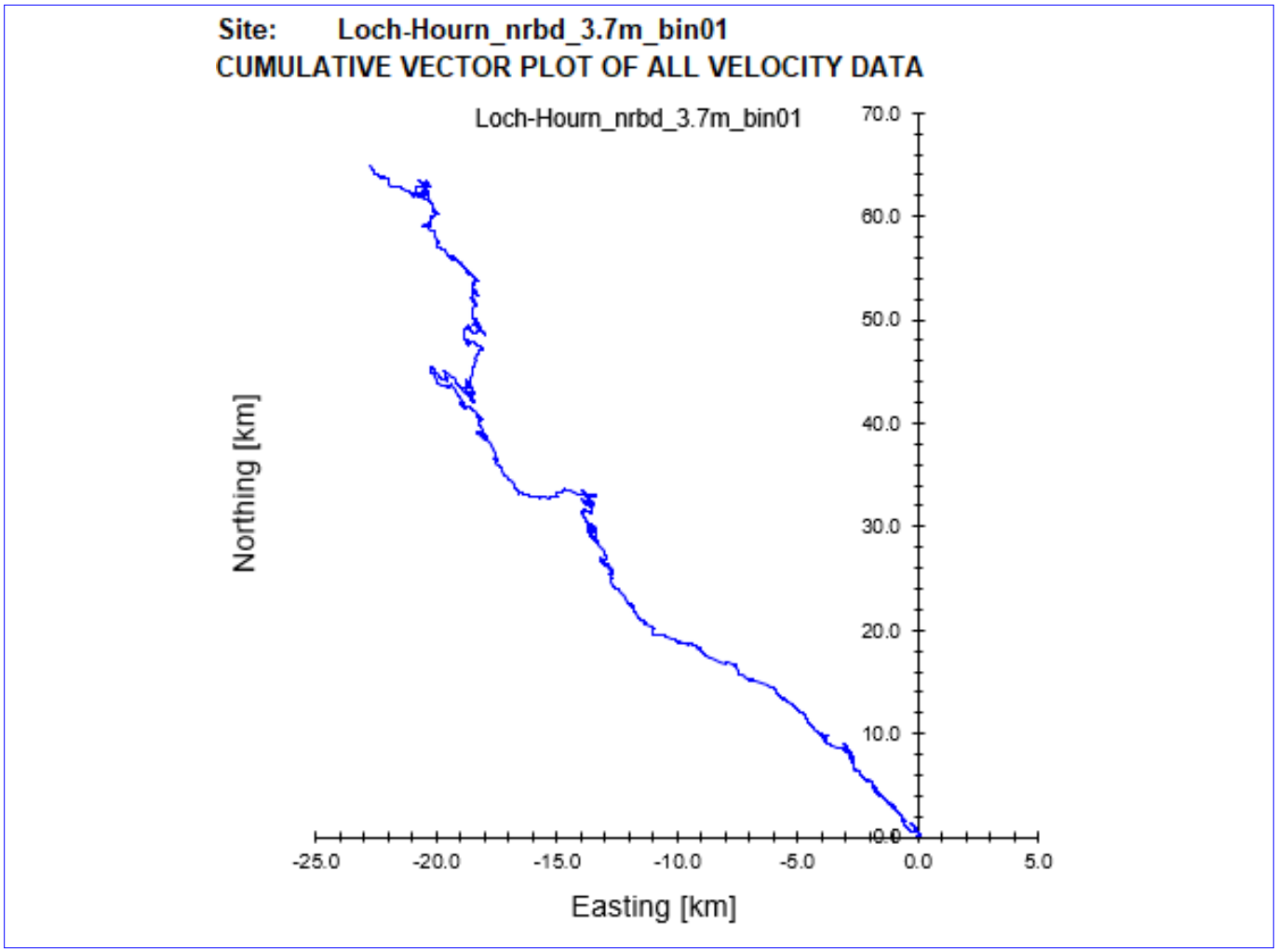


Figure 9. Cumulative Vector Plot of all velocity data from near bottom cell for ID246.

5. Summary of Current Data – ID246

Site Name: Loch Hourn
Data start date: 11/09/2018 **Data end date:** 05/11/2018
Water Depth (mean derived from pressure sensor): 34.61m

Table 2. Summary of current meter deployment

	Cell	Depth Below Surface (m)	Distance from Seabed (m)	Mean current speed (cm/s)
Near surface	25	4.30	27.72	6.58
Cage bottom	14	15.30	16.72	5.28
Near bed	1	28.30	3.72	3.72
			Average current speed:	5.19

Table 3. Ranked percentiles for current speed at all three depths

Cell	Ranked Percentile (%) for mean speed	≤3cm/s (%)	≥4.5cm/s (%)	≥9.5cm/s (%)
Near surface	56	22	63	23
Cage bottom	58	30	51	12
Near bed	59	47	29	3

Cell	Major Axis (Deg-G)
Near surface	330
Cage Bottom	335
Near bed	340

Table 4. Mean and residual currents

	Mean Speed (m/s)	Residual Speed (m/s)	Residual Parallel (m/s)	Residual Normal (m/s)	Tidal Amplitude Parallel (m/s)	Tidal Amplitude Normal (m/s)
Near Surface	0.066	0.04	0.040	0.000	0.091	0.026
Cage Bottom	0.053	0.03	0.029	0.000	0.077	0.022
Near Bed	0.037	0.01	0.014	0.000	0.056	0.024

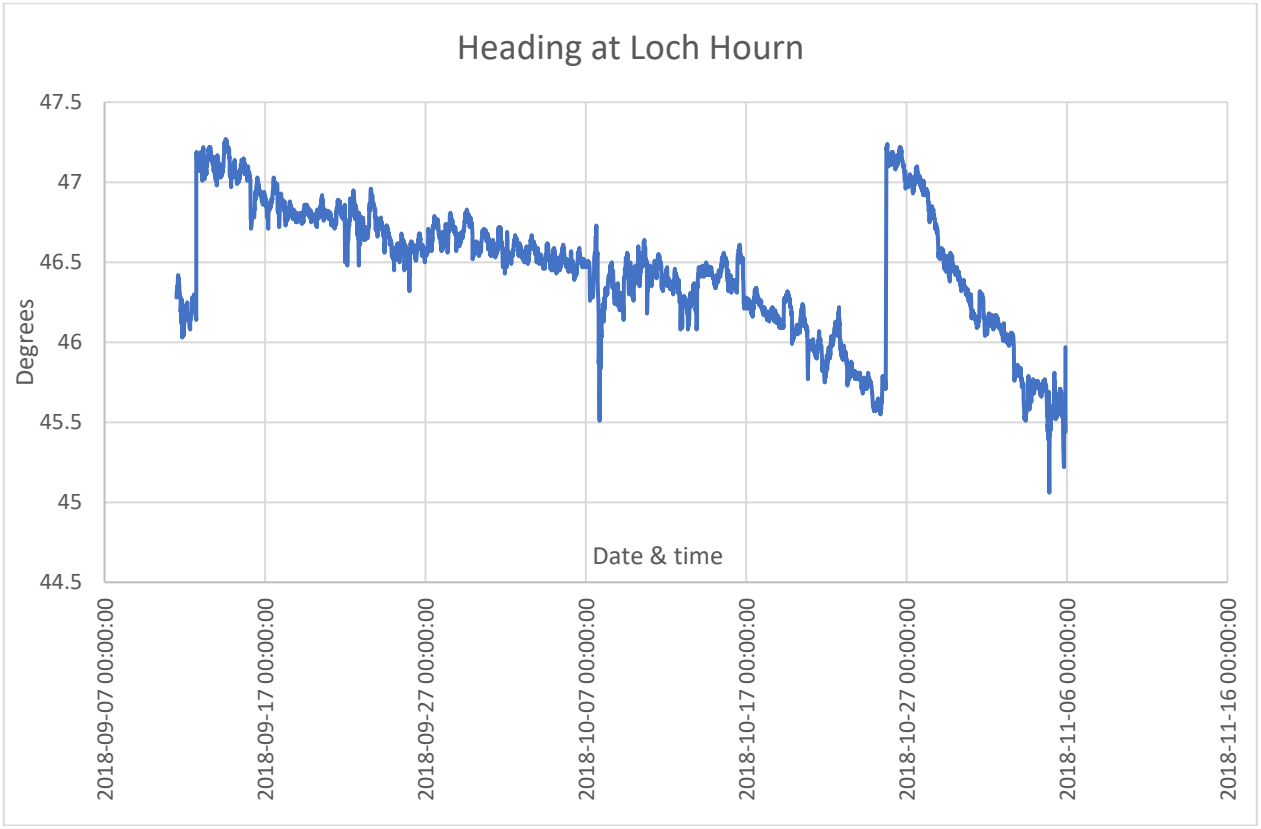


Figure 10. Summary of heading data from deployment ID246.

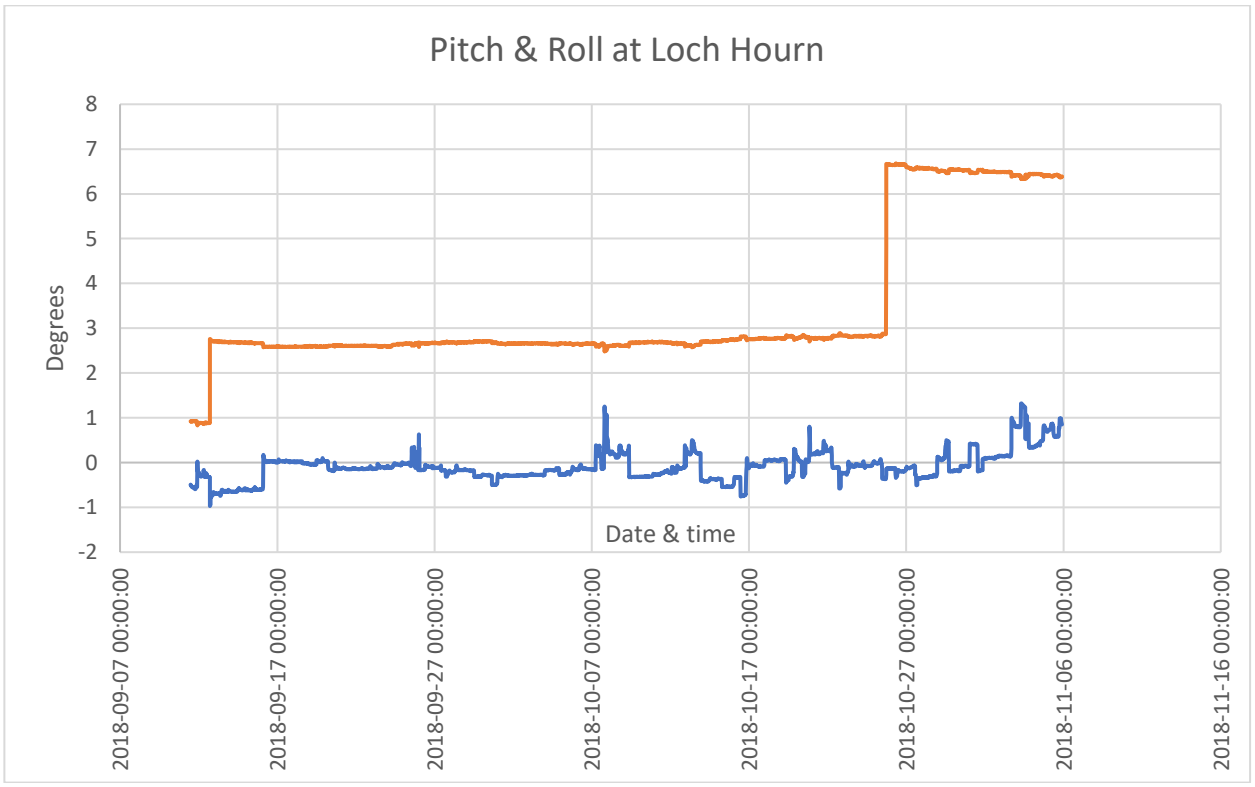


Figure 11. Summary of pitch and roll data from deployment ID246.

6. Conclusion

MOWI has collected and analysed current and bathymetric data for the proposed technical variation at the Loch Hourn fish farm. The analysed current data for the 55 days and 10 hours period are believed to be reliable and representative of the proposed location. The local-area bathymetric data gained from surveying the proposed site, combined with the wider-area UKHO bathymetry data, provided a coherent bathymetric dataset for the site.

Annex 1. Survey Equipment Deployment Log

Sentinel V (ADCP) Current Meter Record Log

Location: Loch Hourn

Nearest tidal port: Loch Hourn Time zone: UTC

Deployment Details

	Time		Date
Meter switched on.	11:40:00		11/09/2018
Meter deployed.	11:40:00		11/09/2018
Meter lifted.	21:40:00		05/11/2018
Meter switched off.	21:40:00		05/11/2018
Period used for this report.	11/09/2018 11:40:00	to	05/11/2018 21:40:00

ADCP serial number: 106

Meter position: 57° 02.720'N, 006° 16.216'W

141094E 803025N

Minimum water depth: 32.02m (31.32m measured by ADCP + 0.7m *)

Water depth (Chart Datum): 31.32m (minimum water depth - 0.7 m tide timetable)

Mean water depth: 34.61m (measured by ADCP + 0.7m *)

Depth of meter from surface: 31.32m (below mean low water spring to transducer)

Depth of meter from seabed: * Meter on seabed 0.7m to transducer head

Sounding at deployment: 36.06m @ 11:40 on 11/09/2018

Data summary:

	Cell number	Depth (m)	Dist from seabed (m)	Mean current speed (cm/s)
Surface	Cell 25	4.30m Below MLWS	27.72m	6.58
Mid depth	Cell 14	15.30m Below MLWS	16.72m	5.28
Bottom	Cell 1	28.30m Below MLWS	3.72m	3.72
Average current speed:				**5.19**

ADCP meter settings:

Reference	Transducer
Bin size	1.0m
Dist to 1st bin	3.02
Number of bins	69
Frequency	307 kHz
Recording interval	20 min
No. pings per ensemble	300
Magnetic correction	0
Ensemble	300
Standard Deviation	0.63cm/sec
Time/Ping	2 seconds

Loch Hourn

Hydrographic Data Report: deployment ID253

29th November to 10th January 2019

August 2021

Mowi Scotland Limited

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QUALITY ASSURANCE

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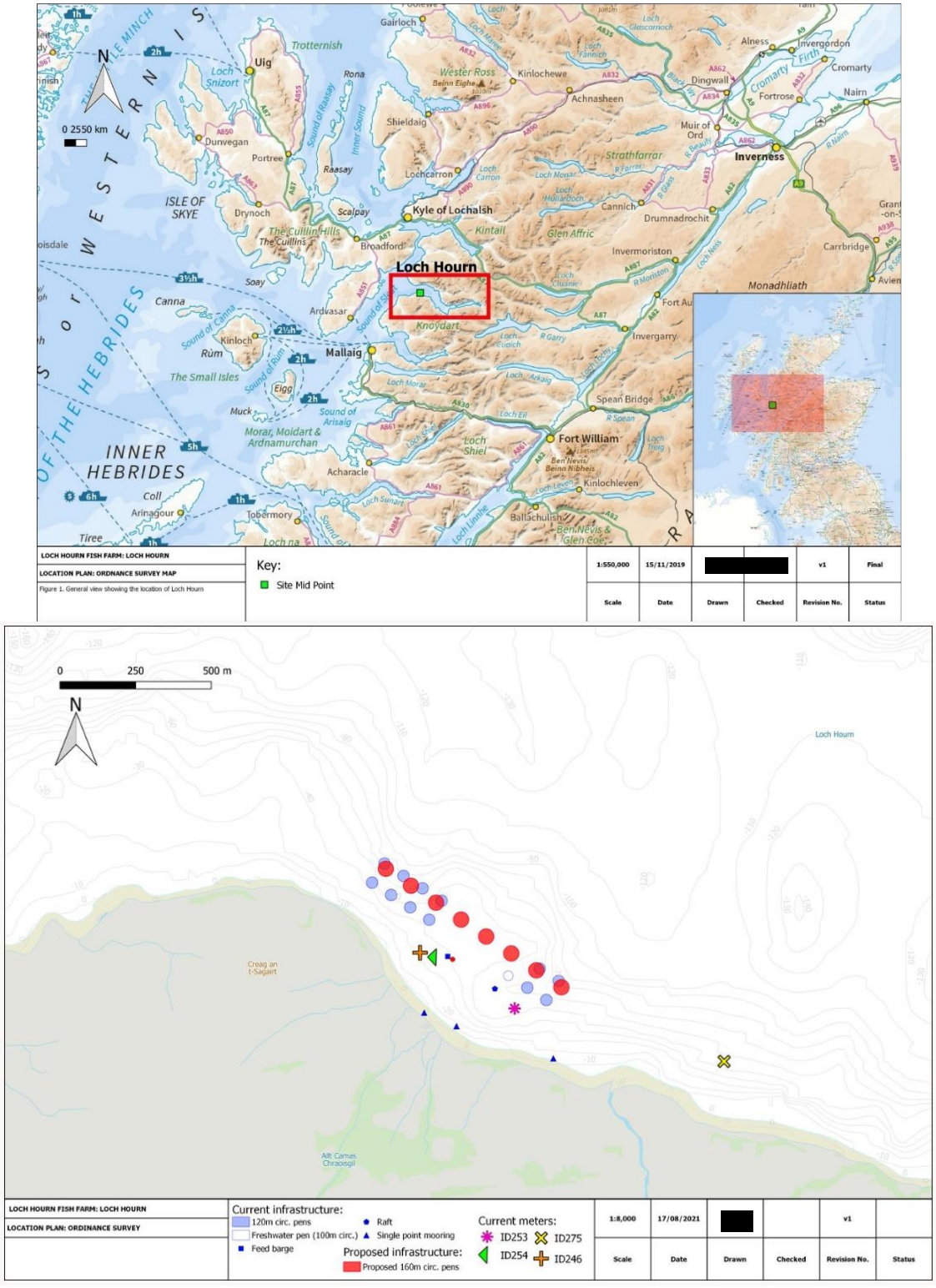

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i. 11th September to 5th November 2018 (ID246)
ii. 29th November to 10th January 2019 (ID253)
iii. 29th November to 11th January 2019 (ID254)
iv. 30th April to 4th July 2019 (ID275)

This report describes the data from the 29th November to 10th January 2019 (deployment ID253) at Loch Hourn. The purpose of this report is to assess the suitability of the collected hydrographic data for input into a hydrodynamic model of the Loch Hourn region and into the NewDepomod model.

2. Materials & Methods

2.1 Depth Survey

Bathymetry for the study area was supplemented by local area bathymetry surveys, and other data sources e.g. the UKHO INSPIRE bathymetry data (http://aws2.caris.com/ukho/mapViewer/map.action). These data were merged into a single dataset and used to provide water depths in the local area (Figure 2).

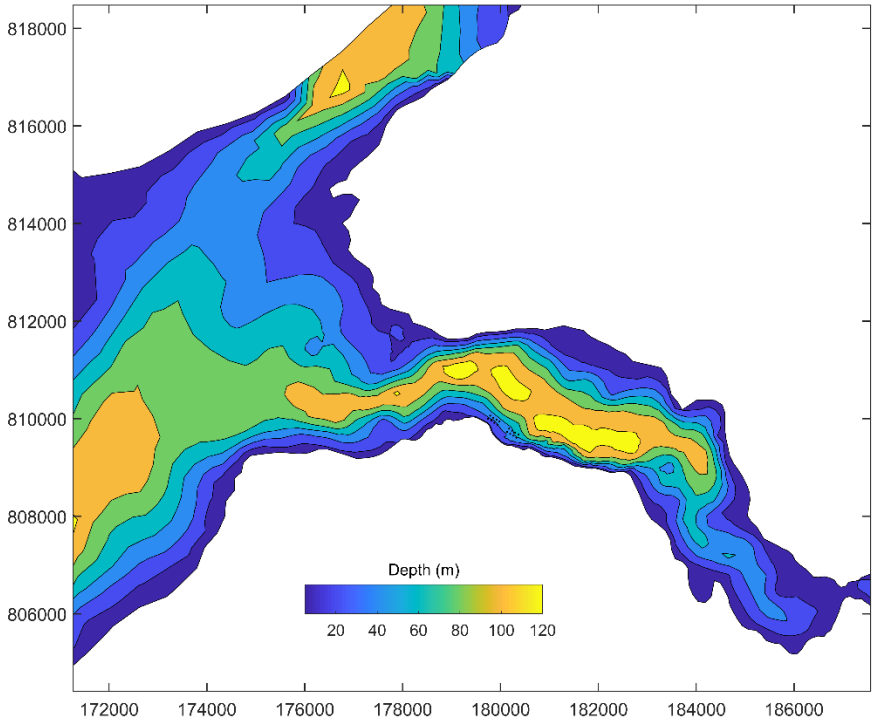


Figure 2. Bathymetry in the region of Loch Hourn.

2.2 Current Data

Mowi staff carried out hydrographic surveys at the site during 2018 – 2019. The purpose of this hydrographic report is to assess the suitability of the collected hydrographic data for use with the NewDepomod model. The data contained in this report were recorded at the site from 29th November to 10th January 2019 (41 days and 21 hours of data; deployment ID253). The data from the other three deployments (ID246, ID254 and ID275) are presented in separate hydrographic reports. In addition to current data, bathymetry data were also collected to support these reports.

The Sentinel V100 (Wide) ADCP (Table 1), within its mooring frame, was positioned at 57.12445N, -5.6325W (180223E 809582N), which was approximately 160m from the nearest shoreline and approximately 270m from the centre of the proposed cage group (Figure 1). The transducer head was 70 cm from the base of the mooring frame. The mean depth (derived from the pressure sensor) at the Sentinel V100 ADCP position was 57.91 m.

Initial soundings were taken to establish the possible depth the Sentinel V100 ADCP would be situated at during high tide and so that the most appropriate cell size could be determined. The cell size was set at 1.0 m and the number of cells to 60.

Data was automatically written and stored to the internal memory within the Sentinel V100 ADCP main body and then downloaded to computer after completion of the deployment period via WiFi.

2.3 Magnetic Variation

No magnetic variation correction was made to the Sentinel V100 ADCP during deployment, this was undertaken to the data after the instrument was recovered and data downloaded. The magnetic variation used was 3.32°; this was determined using the World Magnetic Model, produced jointly with the US National Oceanographic and Atmospheric Administration's National Geophysical Data center. Further details can be found at http://www.geomag.bgs.ac.uk/navigation.html

2.4 Data Processing

Upon retrieval of the Sentinel V100 ADCP current meter, all data was downloaded to a computer for analysis. The raw data file was opened in Teledyne's "Velocity" software and Matlab. Deployment diagnostic data (beam intensity, correlation, pitch and roll) were analysed to confirm that the deployment was successful with the instrument orientated upright. The heading data were also examined to identify any movement of the Sentinel V100 ADCP mooring frame during the deployment.

The diagnostic data suggested that velocities from the first 34 bins were valid (Figure 3). The surface bin should have been around 47 but there were a considerable amount of errors found in the data. Calculations were undertaken to identify the cells to be used for surface and middle currents, taking these errors into consideration. Surface data was taken at an average depth (derived from the pressure sensor) of 18.92 m (cell 34), and cage-bottom data at 23.92 m (cell 29). Surface and middle cell heights were 36.72 m and 31.72 m from the seabed respectively. The bottom cell (cell 1) was at a depth of 51.92 m and 3.72 m above the seabed.

Table 1: Sentinel V100 ADCP Specifications.

Depth Cell Size[1]		**V20 (1000kHz)**		**V50 (500kHz)**		**V100 (300kHz)**	
	Depth Cell Size[1]	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow
	0.25m	18.0/22.6	19.2/36.5				
	0.3m	19.3/24.0	11.1/20.8				
	0.5m	20.2/24.9	7.1/13.4	44.1/57.6	19.2/36.5		
	1.0m	22.1/26.9	3.6/6.7	50.5/64.6	7.1/13.5	94.5/120.6	10.9/20.6
	2.0m	24.5/29.4	1.7/3.2	56.0/70.6	3.6/6.7	103.5/130.4	5.5/10.3
	4.0m	26.9/32.0	0.8/1.6	63.1/78.2	1.7/3.2	114.6/142.3	2.7/5.2
	6.0m			67.4/82.8	1.1/2.1	121.7/151.5	1.8/3.3
Communications and Recording	Wireless	802.11b/g/n					
	Internal memory	One 16GB Micro SD Card included					
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity resolution	0.1cm/s					
	Velocity range	±5m/s (default); ±20m/s (maximum)					
	Ping rate	Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyV—Pre-deployment (testing, planning, and data recovery)[5] Velocity—Post-processing (data handling, display, and export)[6]					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case • AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

1 User's choice of depth cell not limited to the typical values specified.
2 Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.
3 User selects the bandwidth mode; wide = 25% or narrow = 6%.
4 Standard deviations (Std Dev) are typical values for single ping data
5 Resident in ADCP accessed via a web browser.
6 Windows™ based software program.

Specifications subject to change without

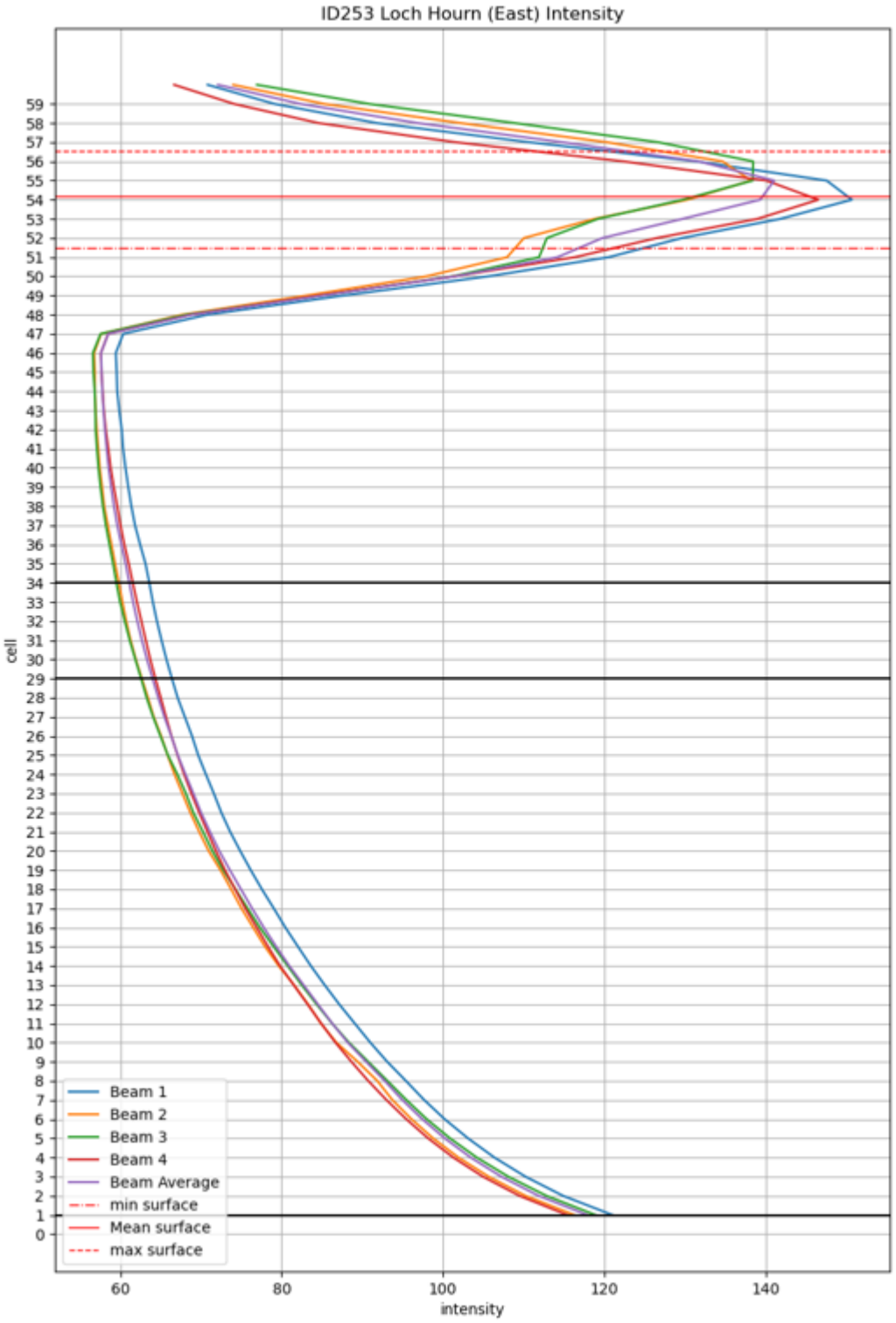


Figure 3. Mean intensity of the ADCP signal for the ID253 dataset plotted by bin number

The 'first cell range' is automatically calculated by the instrument, which is the distance from the transducer head to the first cell. For this deployment, the first cell range was calculated as 3.02 m. This value is then added to the height of the instrument frame (0.7 m) to get the first cell height above the seabed, which equated to 3.72 m.

Standard deviation has been assessed throughout the deployment to identify accurate and reliable data for near bed, middle (net depth) and surface cells using the following equation:

$$Cell\ StdDev = \frac{Instrument\ StdDev}{\sqrt{No.valid\ pings}} \quad (1)$$

The Instrument Standard Deviation (StdDev) in Equation 1 is determined using the deployment settings when the meter is programmed, examples of the StdDev values for different configurations are shown in Table 1. This deployment had a cell size of 1m which equates to an Instrument StdDev of 10.9 cm/s.

The Percentage of valid pings used to calculate Cell StdDev is derived using “Percentage Good” data which allows us to relate the StdDev to the actual data gathered. The percent good data is available for 1, 2, 3 and 4 beams which represent the following:

- Percent good 1 = % of good data computed from 3 Beams
- Percent good 2 = % of bad data due to more than 2 Beam bad
- Percent good 3 = % of bad data due to error velocity exceeded
- Percent good 4 = % of good data computed from 4 Beams

The method described has been used to calculate the Standard deviation throughout the deployment for the surface, middle and bottom cells; the average StdDev values for the surface, middle and bottom was 0.68cm/s, 0.64cm/s and 0.63cm/s respectively which are all within the SEPA criteria of 2cm/s.

2.5 Meteorological Data

The collection of meteorological data is no longer required to support the assessment process and consequently has not been undertaken. The current data used is collected using mulitple deployments and over a longer period and thus provides a more realistic representation of site conditions than short deployments, thus allowing an assessment of the influence of meterological conditions.

3. Results and Discussion

A summary of the current data is shown in Figure 4 to Figure 11 and in Table 2 to Table 4. Over the period analysed for this report, the near-surface, middle and bottom cells had current speed averages of 4.33 cm/s, 3.65 cm/s and 2.64 cm/s respectively. This gave an overall average of 3.54 cm/s. The orientation of the tidal velocities was east, west.

Residual currents at the surface and mid-depth were toward the north-west (286°G and 287°G respectively); near the seabed, the residual flows during the deployment period were to the southeast (098°G, Figure 9). The magnitude of the residual currents for the surface, middle and bottom cells were moderate, with mean values of 0.021 m/s, 0.017 m/s and 0.004 m/s respectively.

4. Hydrographic Data Summary Sheets

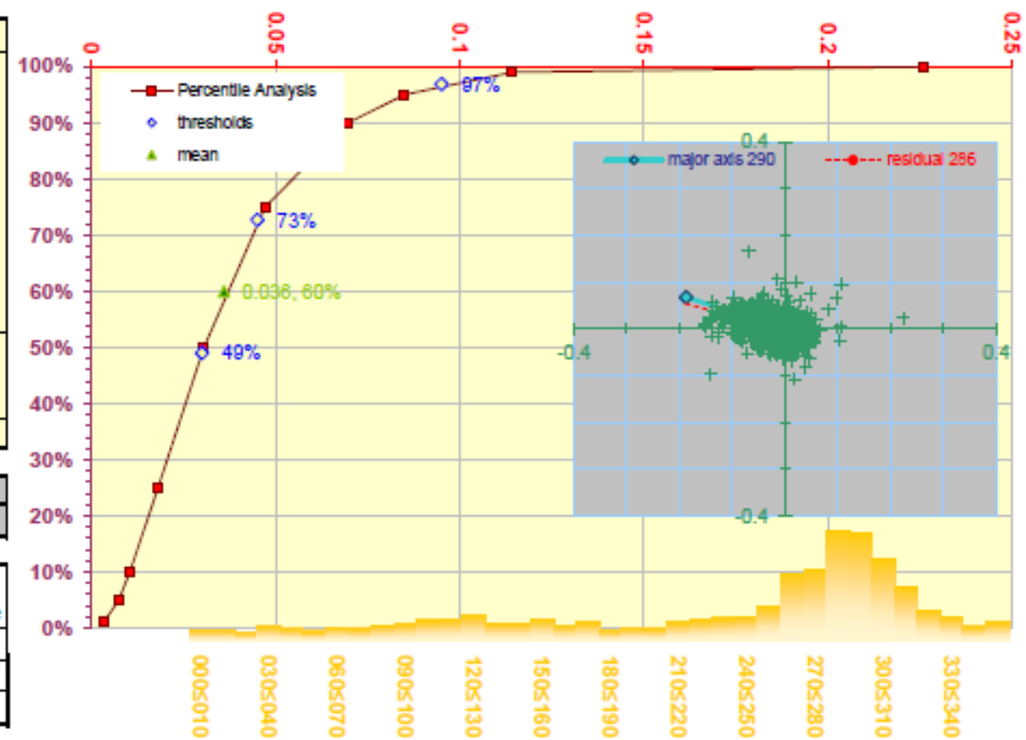
Current meter ID :	LochHourn_subs_36.72m_bin34			180223mE	809582mN
declination:	-3.320	convergence:	-3.049	GMA:	-0.27058 (Deg-M)
Period of measurement :	29/11/18 14:20	to	10/1/19 11:20	41 days	21 hrs	0 mins

Depth/ Pressure	Max:	23.53
	Mean:	21.26
	Min:	18.92

Percentiles	Current Speed	
1%	0.003 m/s	percentile analysis
5%	0.007 m/s	
10%	0.010 m/s	
25%	0.018 m/s	
50%	0.031 m/s	
75%	0.047 m/s	
90%	0.070 m/s	
95%	0.085 m/s	
99%	0.114 m/s	
100%	0.226 m/s	
49%	0.030 m/s	threshold values
73%	0.045 m/s	
97%	0.095 m/s	
60%	0.036 m/s	mean

Major axis :	290 (Deg-M)	0.048 m/s
Residual current :	0.021 m/s	at 286 (Deg-M)

	Residual	Tidal amplitude
Longitudinal (U) :	0.021 m/s	0.048 m/s
Lateral (V) :	-0.001 m/s	0.025 m/s
Anisotropy (long'l/lat'l) :	14.47	1.90



x	y
major axis 290	
-0.188	0.0684
-0.045	0.0163
0	0
######	######
residual 286	
0	0
-0.021	0.0059
-0.192	0.0553

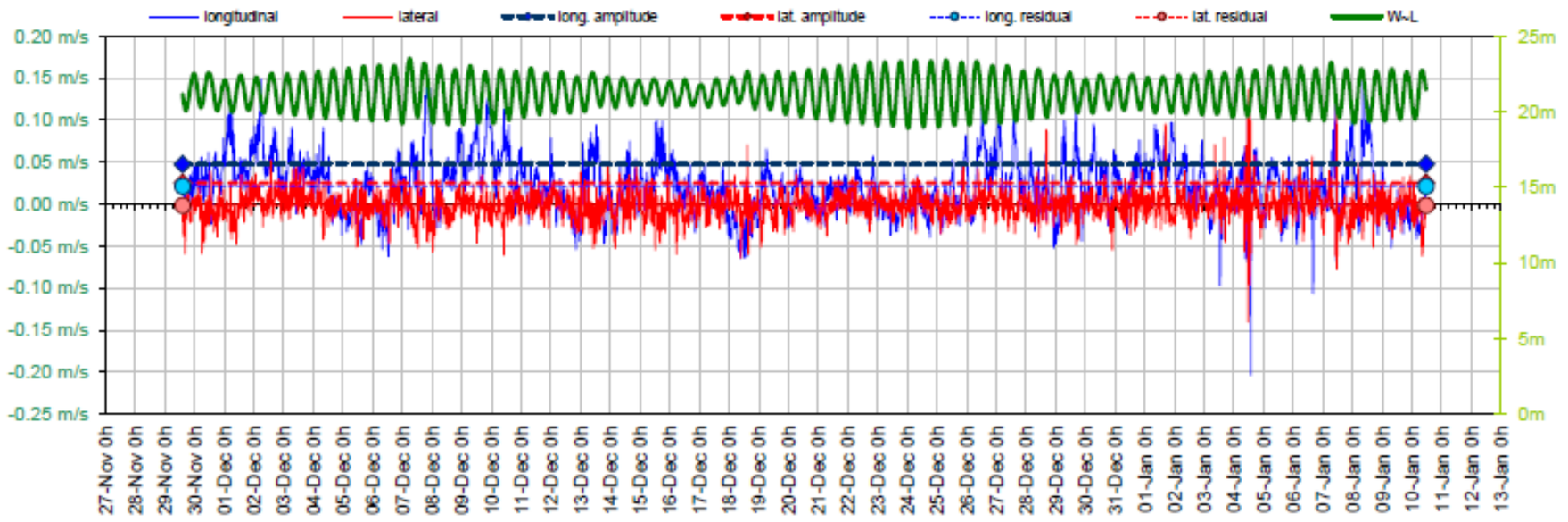


Figure 4. Current Data Summary Sheet for the surface current cell 34, 36.72m from seabed, 29th November to 10th January 2019 inclusive (ID253).

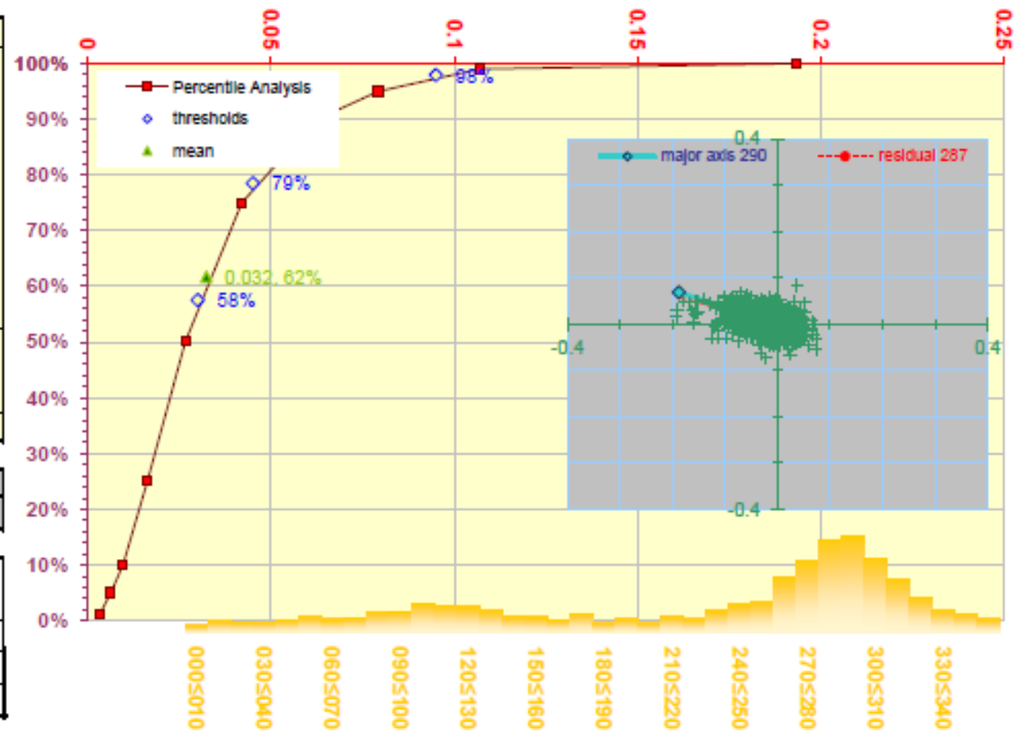
Current meter ID :	Loch-Hourn_cbot_31.72m_bin29			180223mE	809582mN
declination:	-3.320		convergence: -3.049	GMA:	-0.27058 (Deg-M)
Period of measurement :	29/11/18 14:20	to	10/1/19 11:20	41 days	21 hrs	0 mins

Depth/ Pressure	Max:	28.53
	Mean:	26.26
	Min:	23.92

Percentiles	Current Speed	
1%	0.003 m/s	percentile analysis
5%	0.006 m/s	
10%	0.010 m/s	
25%	0.016 m/s	
50%	0.027 m/s	
75%	0.042 m/s	
90%	0.063 m/s	
95%	0.079 m/s	
99%	0.107 m/s	
100%	0.193 m/s	
58%	0.030 m/s	threshold values
79%	0.045 m/s	
98%	0.095 m/s	
62%	0.032 m/s	mean

Major axis :	290 (Deg-M)		0.046 m/s
Residual current :	0.017 m/s	at	287 (Deg-M)

	Residual	Tidal amplitude
Longitudinal (U) :	0.017 m/s	0.046 m/s
Lateral (V) :	-0.001 m/s	0.022 m/s
Anisotropy (long'l/lat'l) :	19.76	2.12



x	y
major axis 290	
-0.188	0.0684
-0.043	0.0157
0	0
######	######
residual 287	
0	0
-0.016	0.0051
-0.191	0.0588

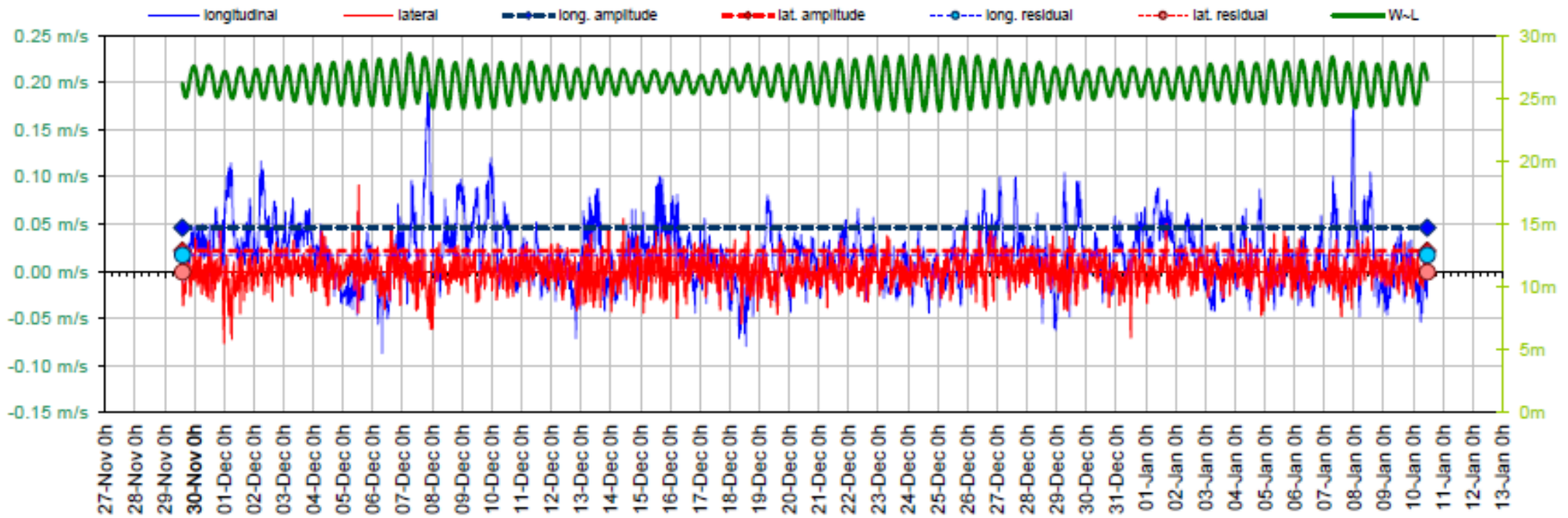


Figure 5. Current Data Summary Sheet for the cage bottom current cell 29, 31.72m from seabed, 29th November to 10th January 2019 inclusive (ID253).

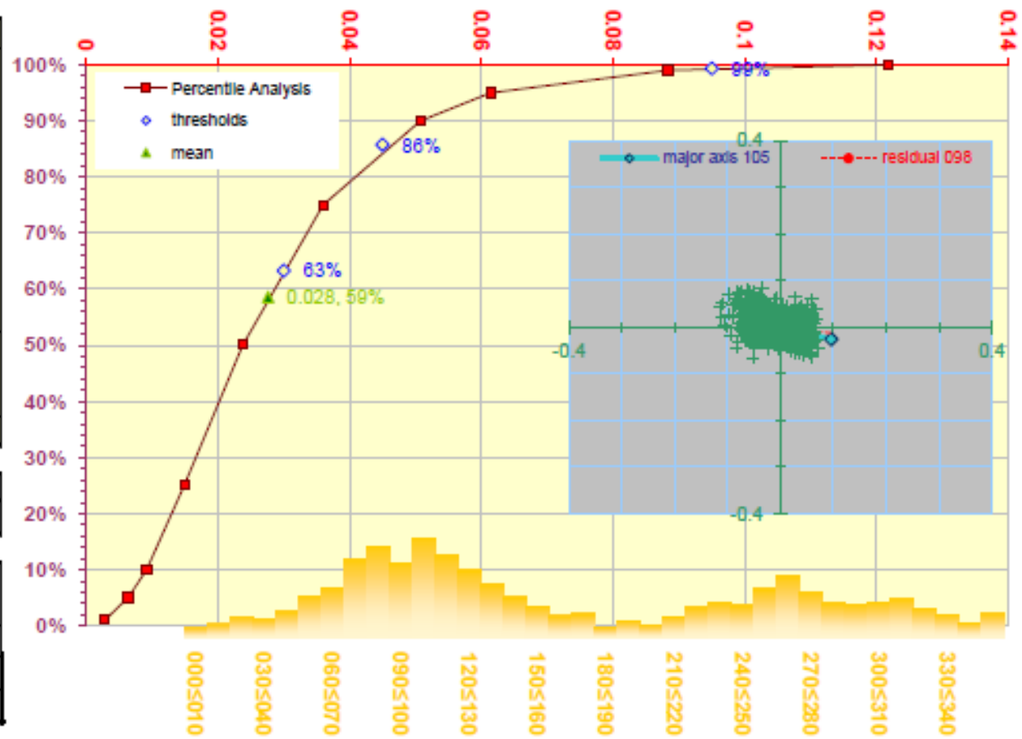
Current meter ID :	Loch-Hourn_nrbd_3.7m_bin1			180223mE	809582mN
declination:	-3.320		convergence: -3.049	GMA:	-0.27058 (Deg-M)
Period of measurement :	29/11/18 14:20	to	10/1/19 11:20	41 days	21 hrs	0 mins

Depth/ Pressure		
	Max:	56.53
	Mean:	54.26
	Min:	51.92

Percentiles	Current Speed	
1%	0.003 m/s	percentile analysis
5%	0.006 m/s	
10%	0.009 m/s	
25%	0.015 m/s	
50%	0.024 m/s	
75%	0.036 m/s	
90%	0.051 m/s	
95%	0.061 m/s	
99%	0.088 m/s	
100%	0.122 m/s	
63%	0.030 m/s	threshold values
86%	0.045 m/s	
99%	0.095 m/s	
59%	0.028 m/s	mean

Major axis :	105 (Deg-M)		0.040 m/s
Residual current :	0.004 m/s	at	098 (Deg-M)

	Residual	Tidal amplitude
Longitudinal (U) :	0.004 m/s	0.040 m/s
Lateral (V) :	0.000 m/s	0.023 m/s
Anisotropy (long'l/lat'l) :	7.78	1.71



x	y
major axis 105	
0.0966	-0.026
0.0384	-0.01
0	0
######	######
residual 098	
0	0
0.0038	-5E-04
0.0991	-0.013

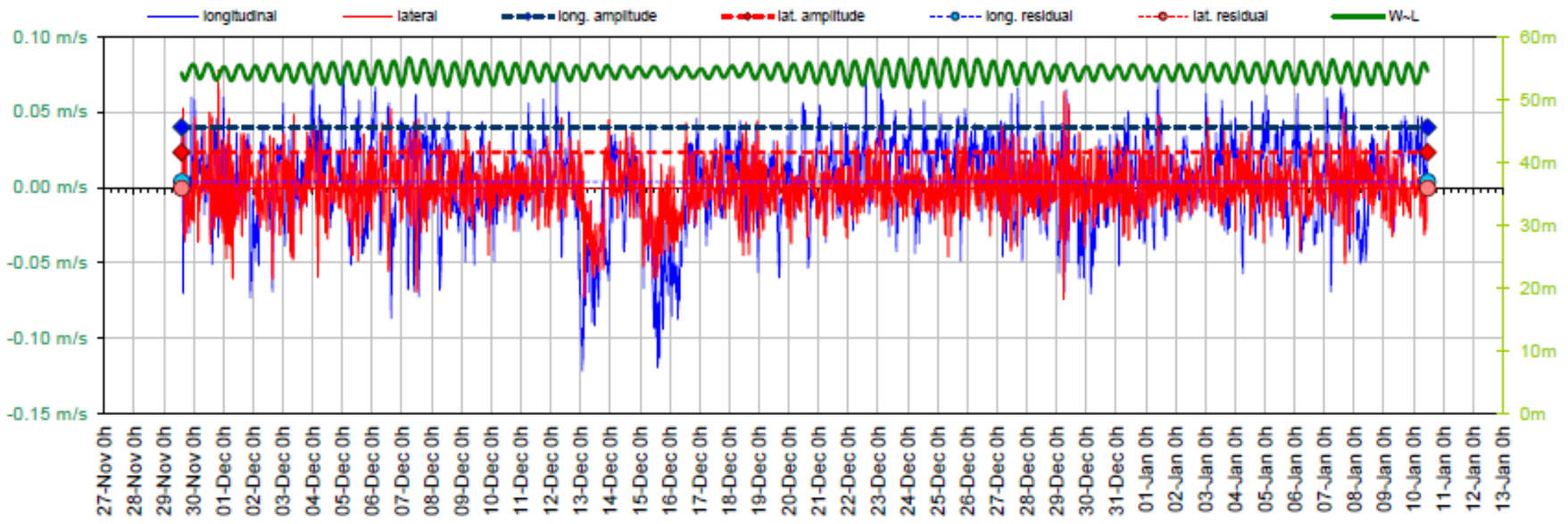


Figure 6. Current Data Summary Sheet for the near bottom current cell 1, 3.7m from seabed, 29th November to 10th January 2019 inclusive (ID253).

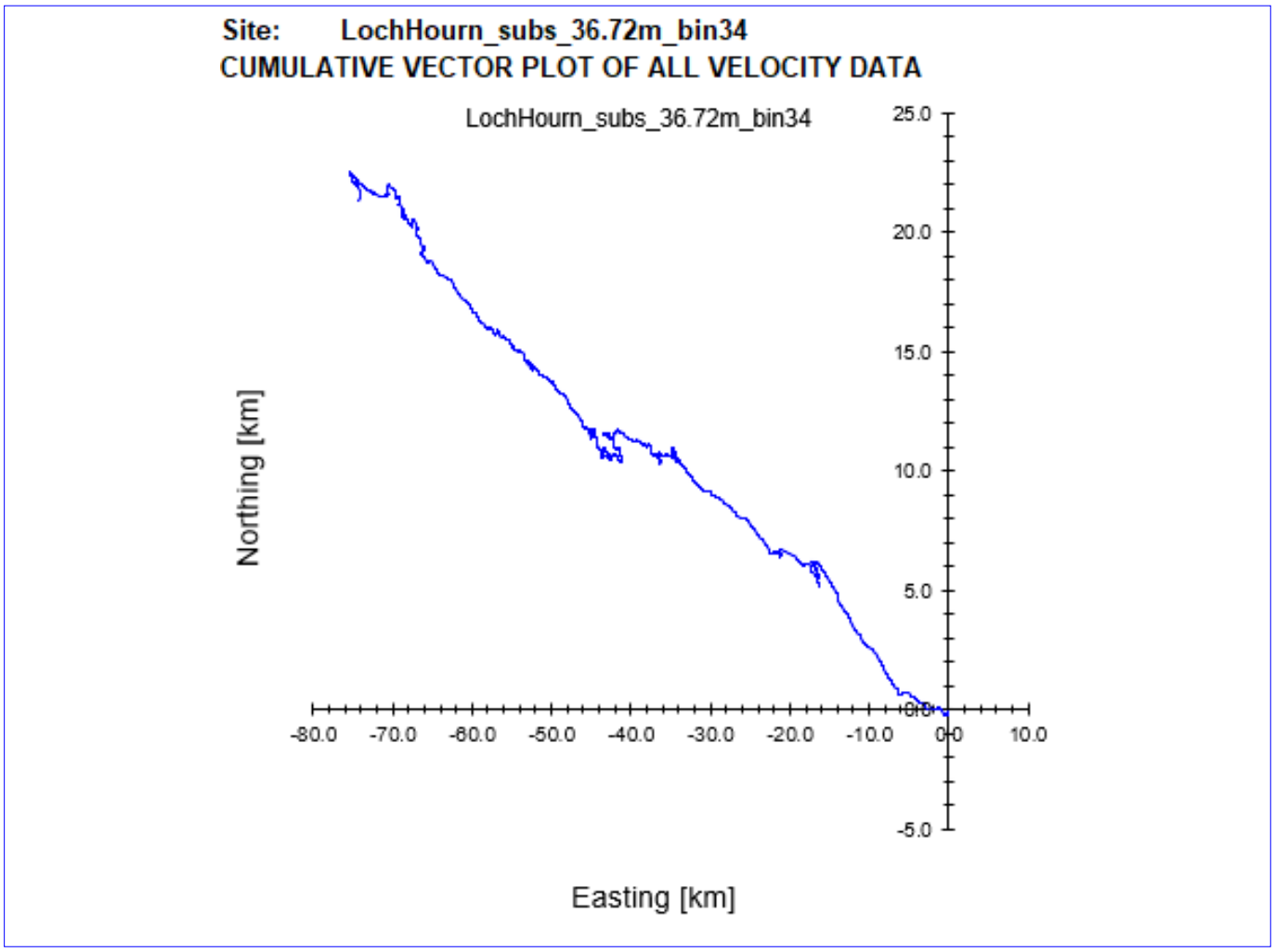


Figure 7. Cumulative Vector Plot of all velocity data from near surface cell for ID253.

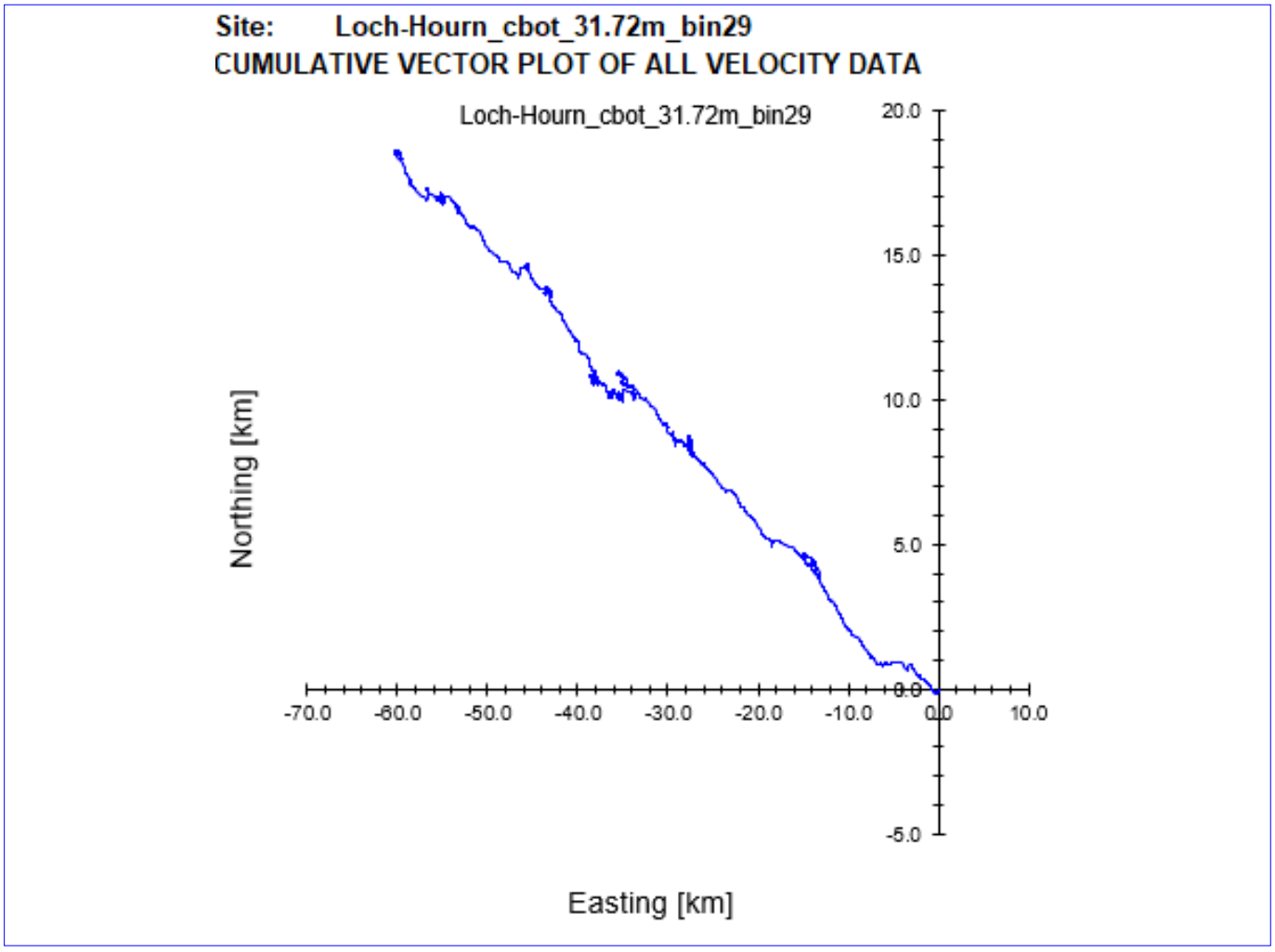


Figure 8. Cumulative Vector Plot of all velocity data from cage bottom cell for ID253.

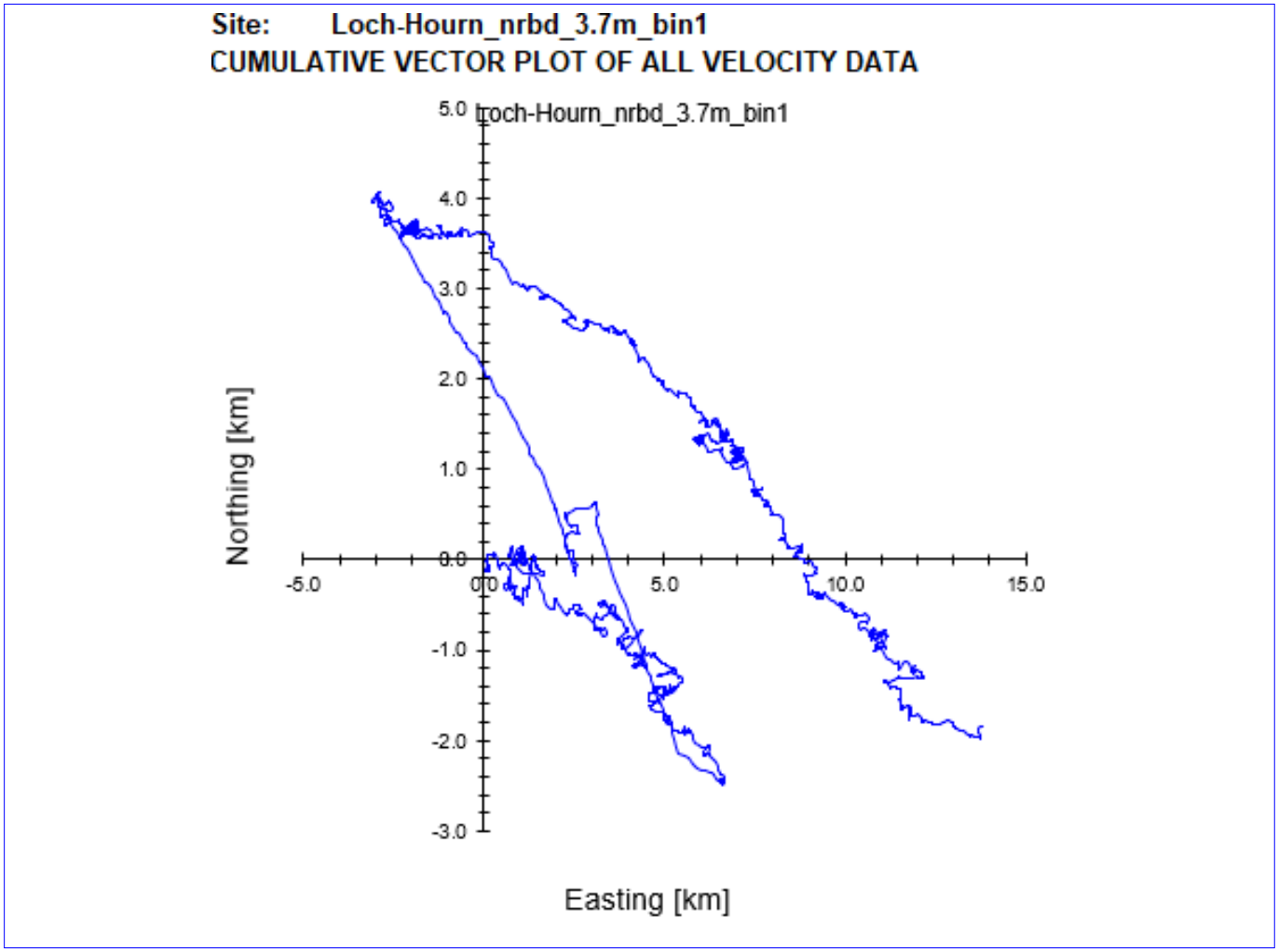


Figure 9. Cumulative Vector Plot of all velocity data from near bottom cell for ID253.

5. Summary of Current Data – ID253

Site Name: Loch Hourn
Data start date: 29/11/2018 **Data end date:** 10/01/2019
Water Depth (mean derived from pressure sensor): 57.91m

Table 2. Summary of current meter deployment

	Cell	Depth Below Surface (m)	Distance from Seabed (m)	Mean current speed (cm/s)
Near surface	34	18.92	36.72	4.33
Cage bottom	29	23.92	31.72	3.65
Near bed	1	51.92	3.72	2.64
			Average current speed:	3.54

Table 3. Ranked percentiles for current speed at all three depths

Cell	Ranked Percentile (%) for mean speed	≤3cm/s (%)	≥4.5cm/s (%)	≥9.5cm/s (%)
Near surface	60	49	27	3
Cage bottom	62	58	21	2
Near bed	59	63	14	1

Cell	Major Axis (Deg-G)
Near surface	290
Cage Bottom	290
Near bed	105

Table 4. Mean and residual currents

	Mean Speed (m/s)	Residual Speed (m/s)	Residual Parallel (m/s)	Residual Normal (m/s)	Tidal Amplitude Parallel (m/s)	Tidal Amplitude Normal (m/s)
Near Surface	0.046	0.021	0.021	-0.001	0.048	0.025
Cage Bottom	0.032	0.017	0.017	-0.001	0.046	0.022
Near Bed	0.028	0.004	0.004	0.000	0.040	0.023

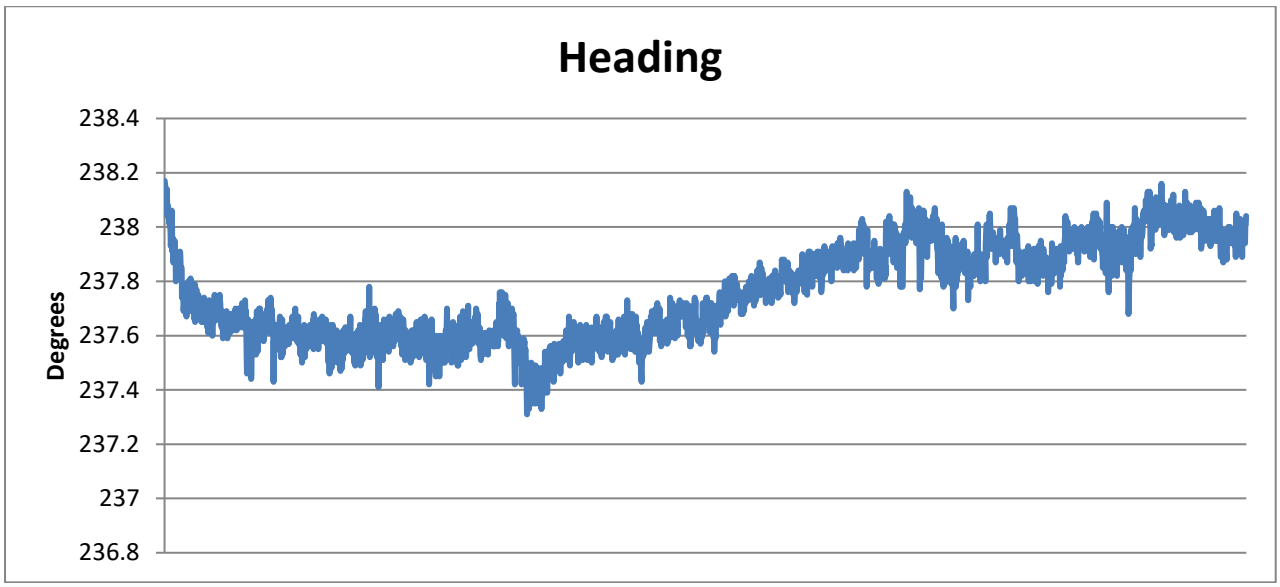


Figure 10. Summary of heading data from deployment ID253.

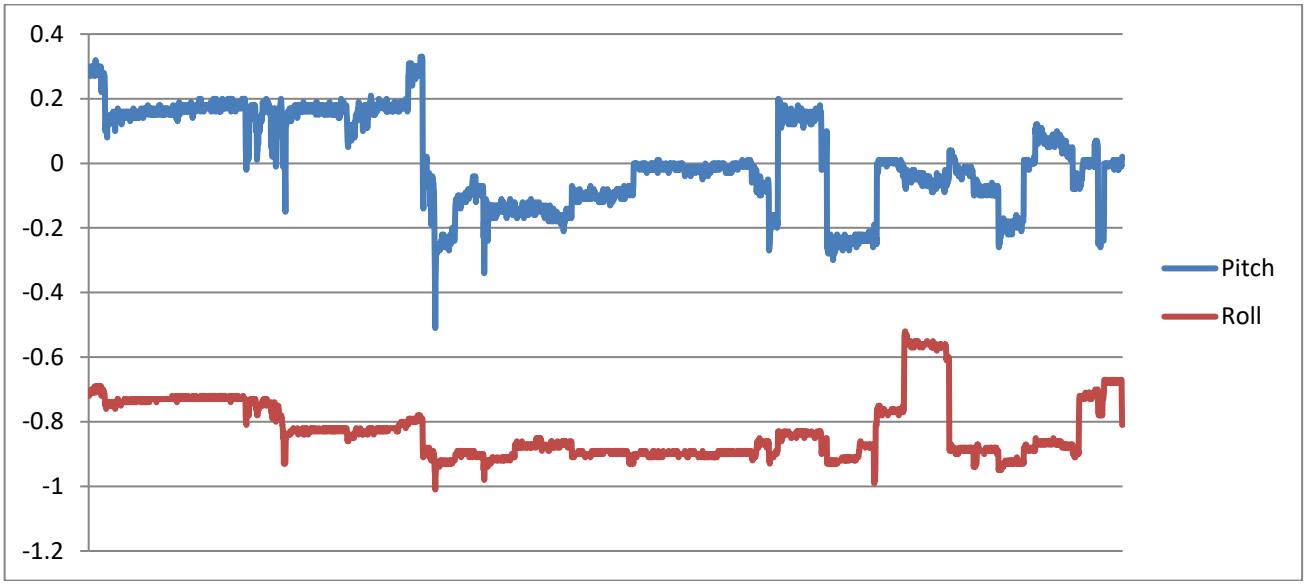


Figure 11. Summary of pitch and roll data from deployment ID253.

6. Conclusion

MOWI has collected and analysed current and bathymetric data for the proposed technical variation at the Loch Hourn fish farm. The analysed current data for the 41 days and 21 hours period are believed to be reliable and representative of the proposed location. The local-area bathymetric data gained from surveying the site, combined with the wider-area UKHO bathymetry data, provided a coherent bathymetric dataset for the site.

Annex 1. Survey Equipment Deployment Log

Sentinel V (ADCP) Current Meter Record Log
Location: Loch Hourn
Nearest tidal port: Loch Hourn Time zone: UTC

Deployment Details:

	Time		Date
Meter switched on.	14:00:00		29/11/2018
Meter deployed.	14:00:00		29/11/2018
Meter lifted.	12:00:00		14/02/2019
Meter switched off.	12:00:00		14/02/2019
Period used for this report.	29/11/2018 14:00:00	to	10/01/2019 11:20:00

ADCP serial number: 24562
Meter position: 57.12445N, -5.6325W
180223E 809582N
Minimum water depth: 55.64m (54.94m measured by ADCP + 0.7m *)
Water depth (Chart Datum): 54.74m (minimum water depth - 0.9 m tide timetable)
Mean water depth: 57.91m (measured by ADCP + 0.7m *)
Depth of meter from surface: 56.09m (below mean low water spring to transducer)
Depth of meter from seabed: * Meter on seabed 0.7m to transducer head
Sounding at deployment: 60m @ 12:30 on 29/11/2018

ADCP meter settings:

Reference	Transducer
Bin size	1.0m
Dist to 1st bin	3.02
Number of bins	60
Frequency	307 kHz
Recording interval	20 min
No. pings per ensemble	300
Magnetic correction	0
Ensemble	300
Standard Deviation	10.9 cm/s
Time/Ping	2 seconds

Loch Hourn

Hydrographic Data Report: deployment ID254

29th November to 11th January 2019

August 2021

Mowi Scotland Limited

[redacted]

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QUALITY ASSURANCE

Mowi Scotland Ltd is ISO9001 and ISO14001 accredited and all project management follows policies designed to ensure that the collection, collation and reporting of information produced in the course of our operations is done to a consistently high standard meeting the requirements of the end user.

1. Introduction

Mowi Scotland Ltd is preparing an application to the Scottish Environmental Protection Agency (SEPA) for a technical variation to CAR/L/1105276 to modify an existing salmon farm site in Loch Hourn. Mowi Scotland Ltd propose to change the existing site from 12 x 120 m circumference pens, with 16m deep nets, in a 75m grid (Figure 1) to 8 x 160 m circumference pens with 20m deep nets which will be held in a 100m grid. An increase to the maximum standing biomass, from 2500T to 3100T, will also be applied for.

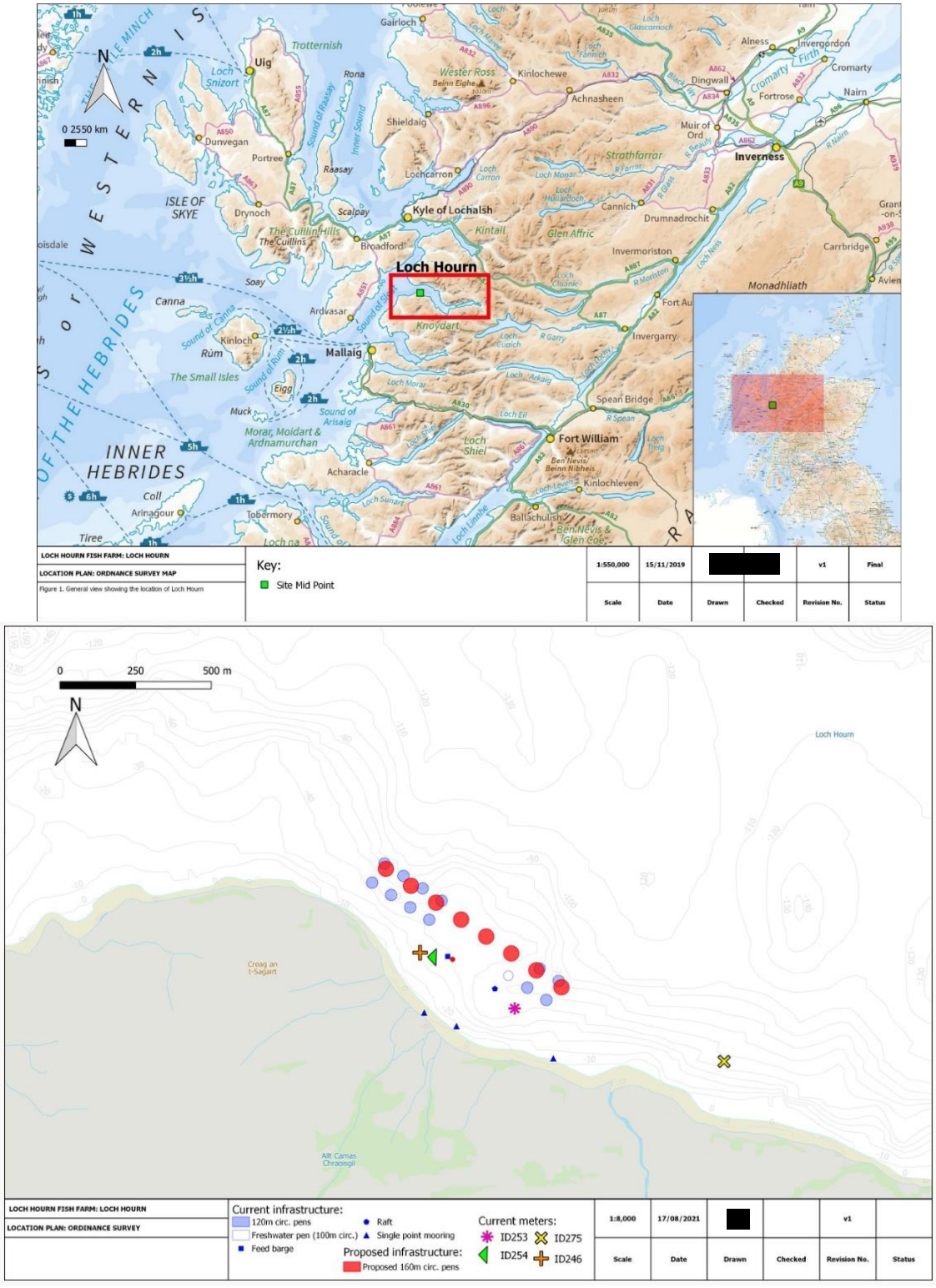


Figure 1. Site location (top) and layout (bottom) and of the salmon farm at Loch Hourn. The current meter deployment locations are marked by the cross, plus, star and triangle

Mowi Scotland Ltd have carried out hydrographic surveys at the site between 2018 and 2019. Hydrographic data at Loch Hourn was gathered between this period in four deployments:

i. 11th September to 5th November 2018 (ID246)
ii. 29th November to 10th January 2019 (ID253)
iii. 29th November to 11th January 2019 (ID254)
iv. 30th April to 4th July 2019 (ID275)

This report describes the data from the 29th November to 11th January 2019 (deployment ID254) at Loch Hourn. The purpose of this report is to assess the suitability of the collected hydrographic data for input into a hydrodynamic model of the Loch Hourn region and into the NewDepomod model.

2. Materials & Methods

2.1 Depth Survey

Bathymetry for the study area was supplemented by local area bathymetry surveys, and other data sources e.g. the UKHO INSPIRE bathymetry data (http://aws2.caris.com/ukho/mapViewer/map.action). These data were merged into a single dataset and used to provide water depths in the local area (Figure 2).

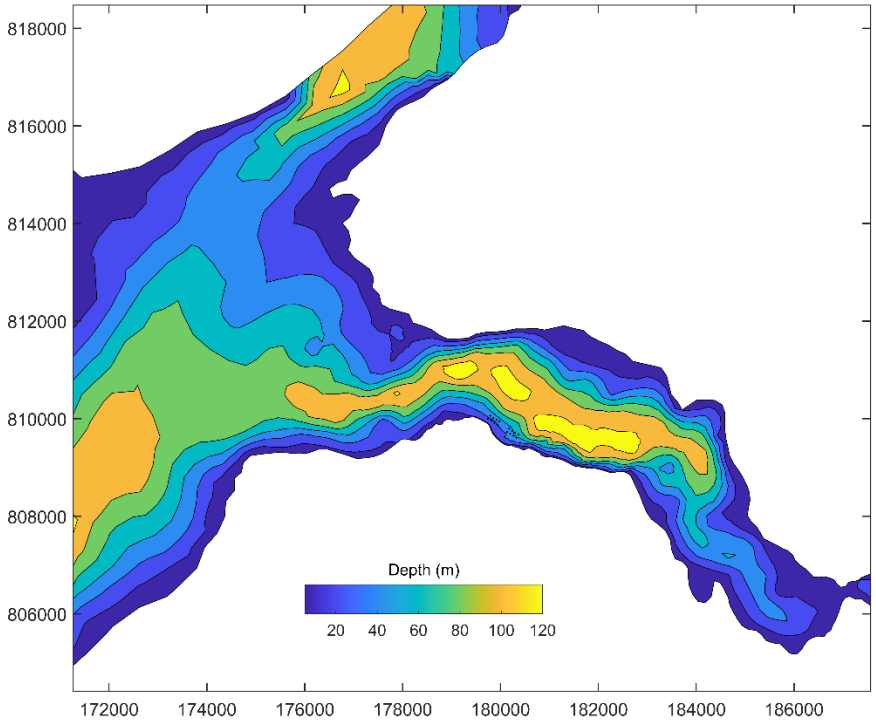


Figure 2. Bathymetry in the region of Loch Hourn.

2.2 Current Data

Mowi staff carried out hydrographic surveys at the site during 2018 – 2019. The purpose of this hydrographic report is to assess the suitability of the collected hydrographic data for use with the NewDepomod model. The data contained in this report were recorded at the site from 29th November to 11th January 2019 (42 days and 22 hours of data; deployment ID254). The data from the other three deployments (ID246, ID253 and ID275) are presented in separate hydrographic reports. In addition to current data, bathymetry data were also collected to support these reports.

The Sentinel V100 (Wide) ADCP (Table 1), within its mooring frame, was positioned at 57.12582N, -5.63783W (179909E 809751N), which was approximately 120m from the nearest shoreline and approximately 180m from the centre of the proposed cage group (Figure 1). The transducer head was 70 cm from the base of the mooring frame. The mean depth (derived from the pressure sensor) at the Sentinel V100 ADCP position was 36.76 m.

Initial soundings were taken to establish the possible depth the Sentinel V100 ADCP would be situated at during high tide and so that the most appropriate cell size could be determined. The cell size was set at 1.0 m and the number of cells to 59.

Data was automatically written and stored to the internal memory within the Sentinel V100 ADCP main body and then downloaded to computer after completion of the deployment period via WiFi.

2.3 Magnetic Variation

No magnetic variation correction was made to the Sentinel V100 ADCP during deployment, this was undertaken to the data after the instrument was recovered and data downloaded. The magnetic variation used was 3.32°; this was determined using the World Magnetic Model, produced jointly with the US National Oceanographic and Atmospheric Administration's National Geophysical Data center. Further details can be found at http://www.geomag.bgs.ac.uk/navigation.html

2.4 Data Processing

Upon retrieval of the Sentinel V100 ADCP current meter, all data was downloaded to a computer for analysis. The raw data file was opened in Teledyne's "Velocity" software and Matlab. Deployment diagnostic data (beam intensity, correlation, pitch and roll) were analysed to confirm that the deployment was successful with the instrument orientated upright. The heading data were also examined to identify any movement of the Sentinel V100 ADCP mooring frame during the deployment.

The diagnostic data suggested that velocities from the first 26 bins were valid (Figure 3). Calculations were undertaken to identify the cells to be used for surface and middle currents. Surface data was taken at an average depth (derived from the pressure sensor) of 5.78 m (cell 26), and cage-bottom data at 15.78 m (cell 16). Surface and middle cell heights were 28.72 m and 18.72 m from the seabed respectively. The bottom cell (cell 1) was at a depth of 30.78 m and 3.72 m above the seabed.

Table 1: Sentinel V100 ADCP Specifications.

Depth Cell Size[1]		**V20 (1000kHz)**		**V50 (500kHz)**		**V100 (300kHz)**	
	Depth Cell Size[1]	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow
	0.25m	18.0/22.6	19.2/36.5				
	0.3m	19.3/24.0	11.1/20.8				
	0.5m	20.2/24.9	7.1/13.4	44.1/57.6	19.2/36.5		
	1.0m	22.1/26.9	3.6/6.7	50.5/64.6	7.1/13.5	94.5/120.6	10.9/20.6
	2.0m	24.5/29.4	1.7/3.2	56.0/70.6	3.6/6.7	103.5/130.4	5.5/10.3
	4.0m	26.9/32.0	0.8/1.6	63.1/78.2	1.7/3.2	114.6/142.3	2.7/5.2
	6.0m			67.4/82.8	1.1/2.1	121.7/151.5	1.8/3.3
Communications and Recording	Wireless	802.11b/g/n					
	Internal memory	One 16GB Micro SD Card included					
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity resolution	0.1cm/s					
	Velocity range	±5m/s (default); ±20m/s (maximum)					
	Ping rate	Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyV—Pre-deployment (testing, planning, and data recovery)[5] Velocity—Post-processing (data handling, display, and export)[6]					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case • AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

1 User's choice of depth cell not limited to the typical values specified.
2 Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.
3 User selects the bandwidth mode; wide = 25% or narrow = 6%.
4 Standard deviations (Std Dev) are typical values for single ping data
5 Resident in ADCP accessed via a web browser.
6 Windows™ based software program.

Specifications subject to change without

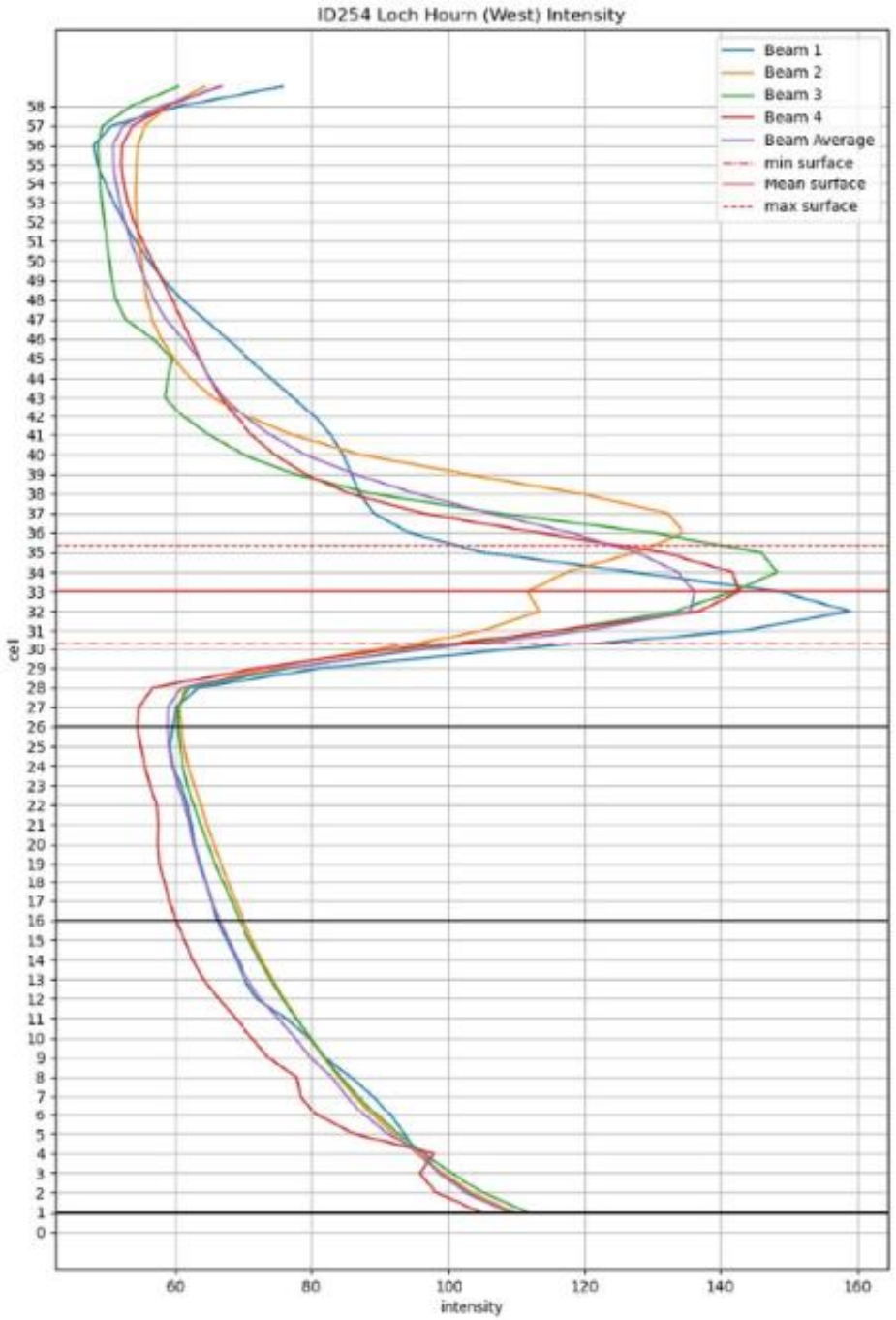


Figure 3. Mean intensity of the ADCP signal for the ID254 dataset plotted by bin number

The 'first cell range' is automatically calculated by the instrument, which is the distance from the transducer head to the first cell. For this deployment, the first cell range was calculated as 3.02 m. This value is then added to the height of the instrument frame (0.7 m) to get the first cell height above the seabed, which equated to 3.72 m.

Standard deviation has been assessed throughout the deployment to identify accurate and reliable data for near bed, middle (net depth) and surface cells using the following equation:

$$Cell\ StdDev = \frac{Instrument\ StdDev}{\sqrt{No.valid\ pings}} \qquad (1)$$

The Instrument Standard Deviation (StdDev) in Equation 1 is determined using the deployment settings when the meter is programmed, examples of the StdDev values for different configurations are shown in Table 1. This deployment had a cell size of 1m which equates to an Instrument StdDev of 10.9 cm/s.

The Percentage of valid pings used to calculate Cell StdDev is derived using “Percentage Good” data which allows us to relate the StdDev to the actual data gathered. The percent good data is available for 1, 2, 3 and 4 beams which represent the following:

- Percent good 1 = % of good data computed from 3 Beams
- Percent good 2 = % of bad data due to more than 2 Beam bad
- Percent good 3 = % of bad data due to error velocity exceeded
- Percent good 4 = % of good data computed from 4 Beams

The method described has been used to calculate the Standard deviation throughout the deployment for the surface, middle and bottom cells; the average StdDev values for the surface, middle and bottom was 0.67cm/s, 0.63cm/s and 0.63cm/s respectively which are all within the SEPA criteria of 2cm/s.

2.5 Meteorological Data

The collection of meteorological data is no longer required to support the assessment process and consequently has not been undertaken. The current data used is collected using mulitple deployments and over a longer period and thus provides a more realistic representation of site conditions than short deployments, thus allowing an assessment of the influence of meterological conditions.

3. Results and Discussion

A summary of the current data is shown in Figure 4 to Figure 11 and in Table 2 to Table 4. Over the period analysed for this report, the near-surface, middle and bottom cells had current speed averages of 5.68 cm/s, 4.25 cm/s and 4.07 cm/s respectively. This gave an overall average of 4.67 cm/s. The orientation of the tidal velocities was southeast, northwest.

Residual currents at all three bins were toward the north-west, 326°G at the surface, 307°G at cage bottom and 354°G near the seabed. The magnitude of the residual currents for the surface, middle and bottom cells were moderate, with mean values of 0.014 m/s, 0.014 m/s and 0.013 m/s respectively.

4. Hydrographic Data Summary Sheets

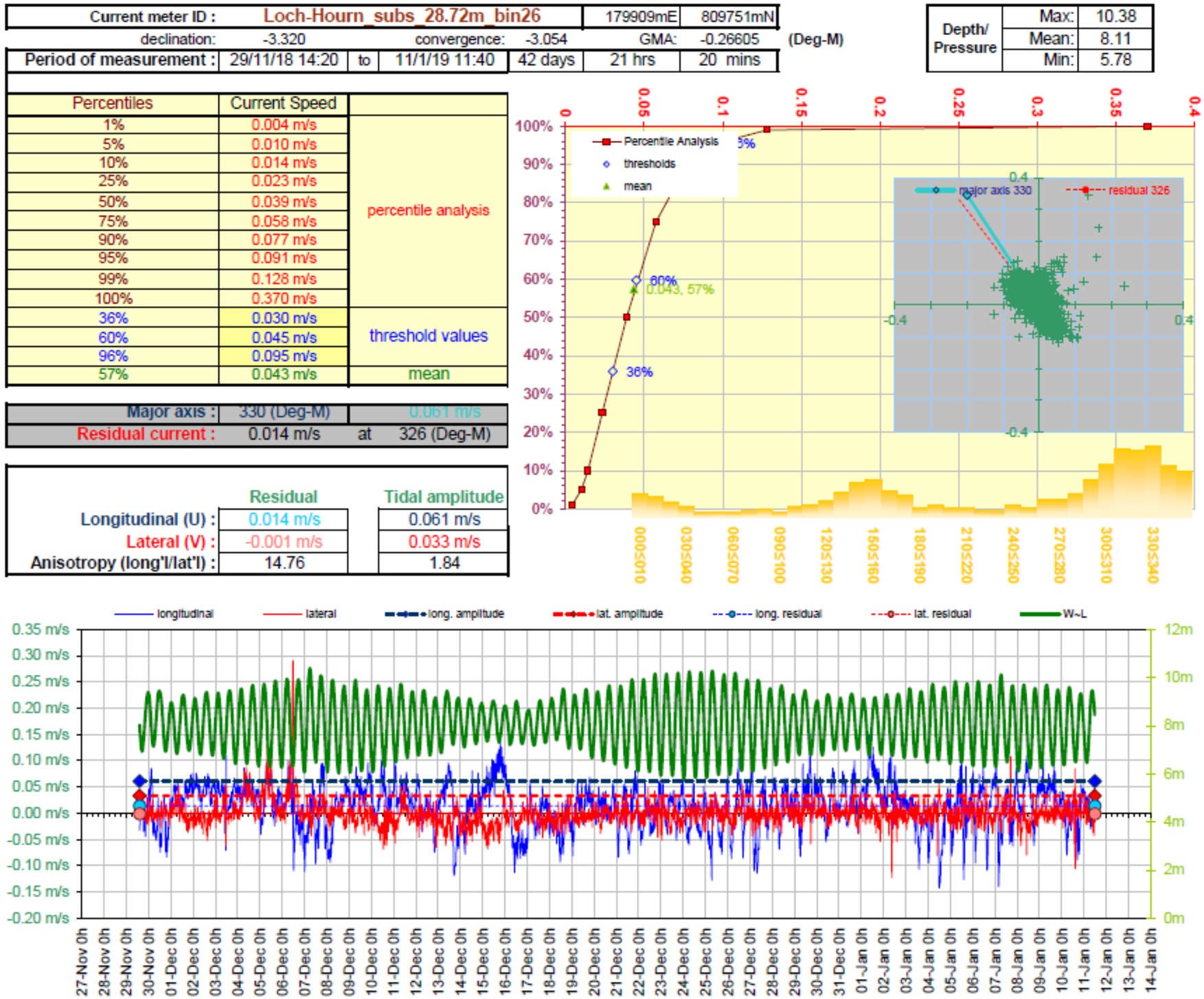


Figure 4. Current Data Summary Sheet for the surface current cell 26, 28.72m from seabed, 29th November to 11th January 2019 inclusive (ID254).

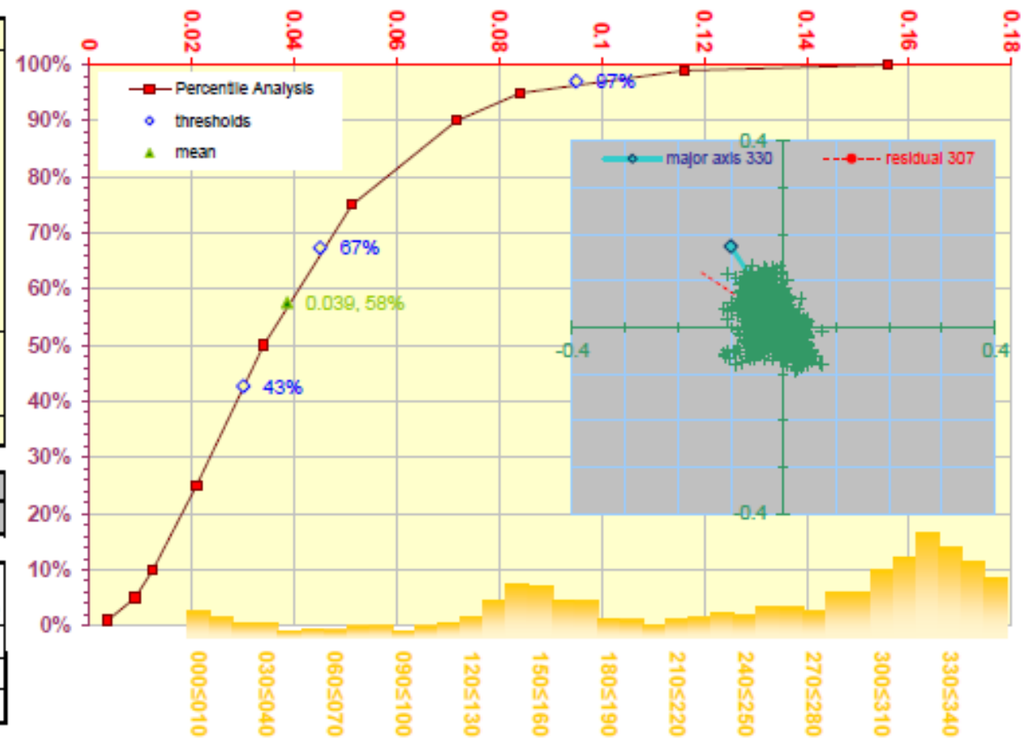
Current meter ID :	Loch-Hourn_cbot_18.72m_bin16			179909mE	809751mN
declination:	-3.320		convergence: -3.054	GMA:	-0.26605 (Deg-M)
Period of measurement :	29/11/18 14:20	to	11/1/19 11:40	42 days	21 hrs 20 mins

Depth/ Pressure	Max:	20.38
	Mean:	18.11
	Min:	15.78

Percentiles	Current Speed	
1%	0.004 m/s	percentile analysis
5%	0.009 m/s	
10%	0.012 m/s	
25%	0.021 m/s	
50%	0.034 m/s	
75%	0.051 m/s	
90%	0.072 m/s	
95%	0.084 m/s	
99%	0.116 m/s	
100%	0.156 m/s	
43%	0.030 m/s	threshold values
67%	0.045 m/s	
97%	0.095 m/s	
58%	0.039 m/s	mean

Major axis :	330 (Deg-M)		0.053 m/s
Residual current :	0.014 m/s	at	307 (Deg-M)

	Residual	Tidal amplitude
Longitudinal (U) :	0.013 m/s	0.053 m/s
Lateral (V) :	-0.005 m/s	0.029 m/s
Anisotropy (long'l/lat'l) :	2.36	1.81



x	y
major axis 330	
-0.1	0.1732
-0.027	0.0463
0	0
######	######
residual 307	
0	0
-0.011	0.0085
-0.16	0.1205

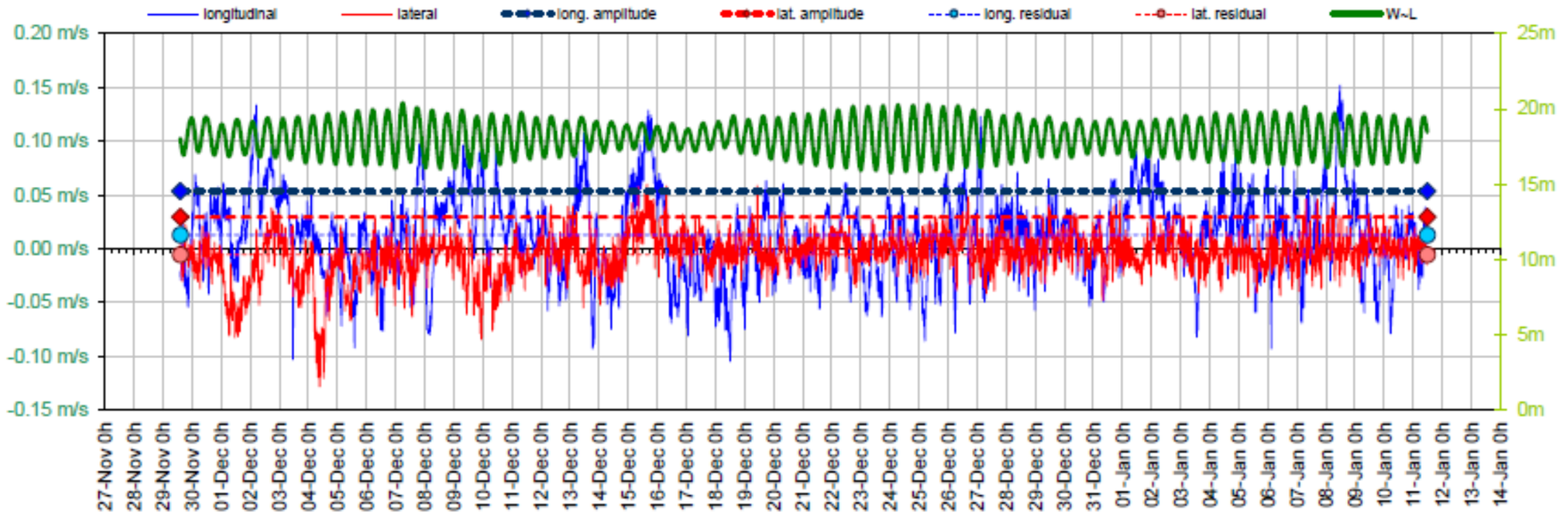


Figure 5. Current Data Summary Sheet for the cage bottom current cell 16, 18.72m from seabed, 29th November to 11th January 2019 inclusive (ID254).

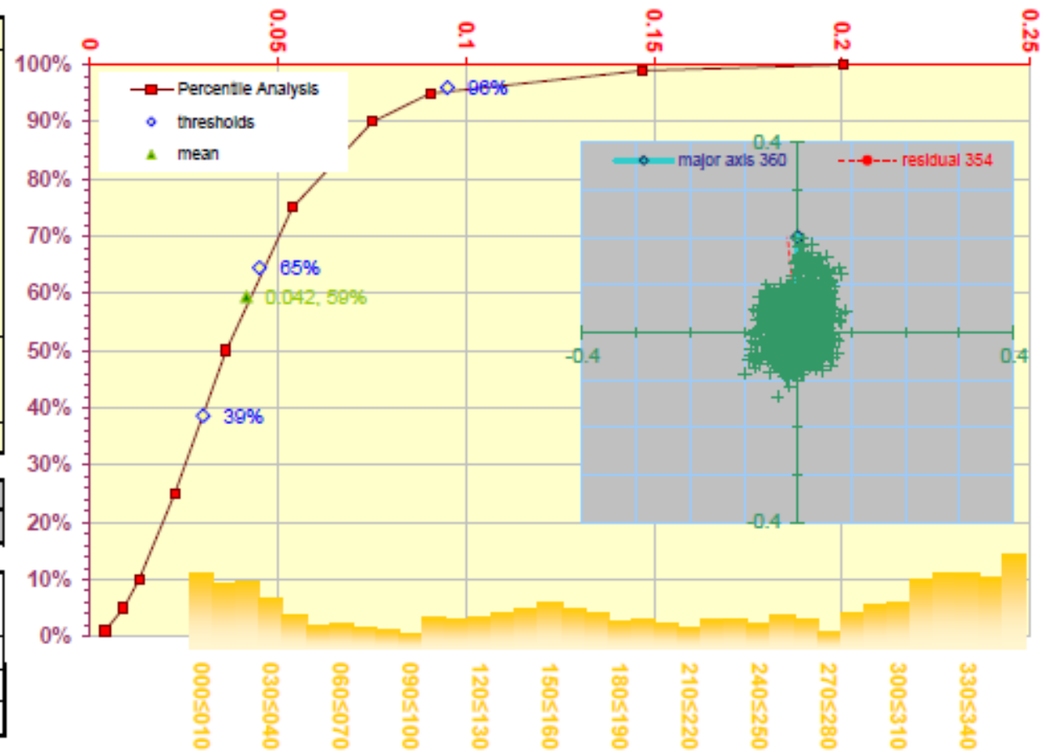
Current meter ID :	Loch-Hourn_nrbd_3.72m_cell1			179909mE	809751mN
declination:	-3.320		convergence: -3.054	GMA:	-0.26605 (Deg-M)
Period of measurement :	29/11/18 14:20	to	11/1/19 11:40	42 days	21 hrs 20 mins

Depth/ Pressure	Max:	35.38
	Mean:	33.11
	Min:	30.78

Percentiles	Current Speed	
1%	0.004 m/s	percentile analysis
5%	0.009 m/s	
10%	0.013 m/s	
25%	0.023 m/s	
50%	0.036 m/s	
75%	0.054 m/s	
90%	0.075 m/s	
95%	0.090 m/s	
99%	0.147 m/s	
100%	0.200 m/s	
39%	0.030 m/s	threshold values
65%	0.045 m/s	
96%	0.095 m/s	
59%	0.042 m/s	mean

Major axis :	360 (Deg-M)	0.057 m/s
Residual current :	0.013 m/s	at 354 (Deg-M)

	Residual	Tidal amplitude
Longitudinal (U) :	0.013 m/s	0.057 m/s
Lateral (V) :	-0.001 m/s	0.037 m/s
Anisotropy (long'l/lat'l) :	10.30	1.54



x	y
major axis 360	
-5E-17	0.2
-1E-17	0.057
0	0
######	######
residual 354	
0	0
-0.001	0.0128
-0.019	0.1991

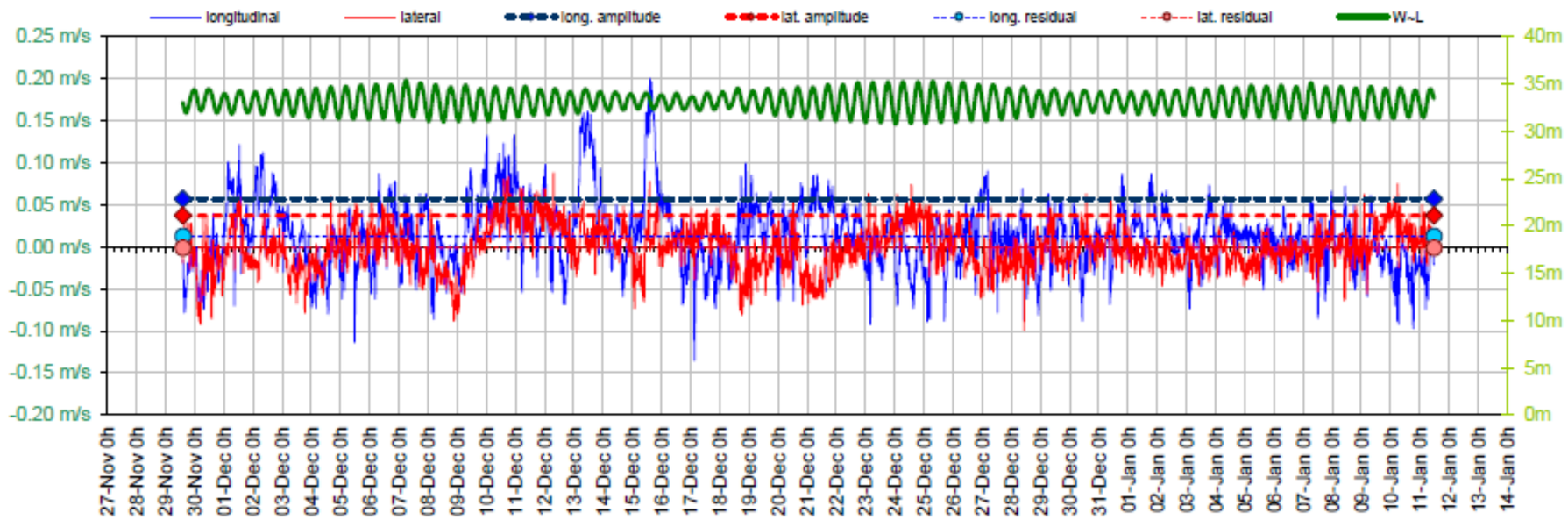


Figure 6. Current Data Summary Sheet for the near bottom current cell 1, 3.7m from seabed, 29th November to 11th January 2019 inclusive (ID254).

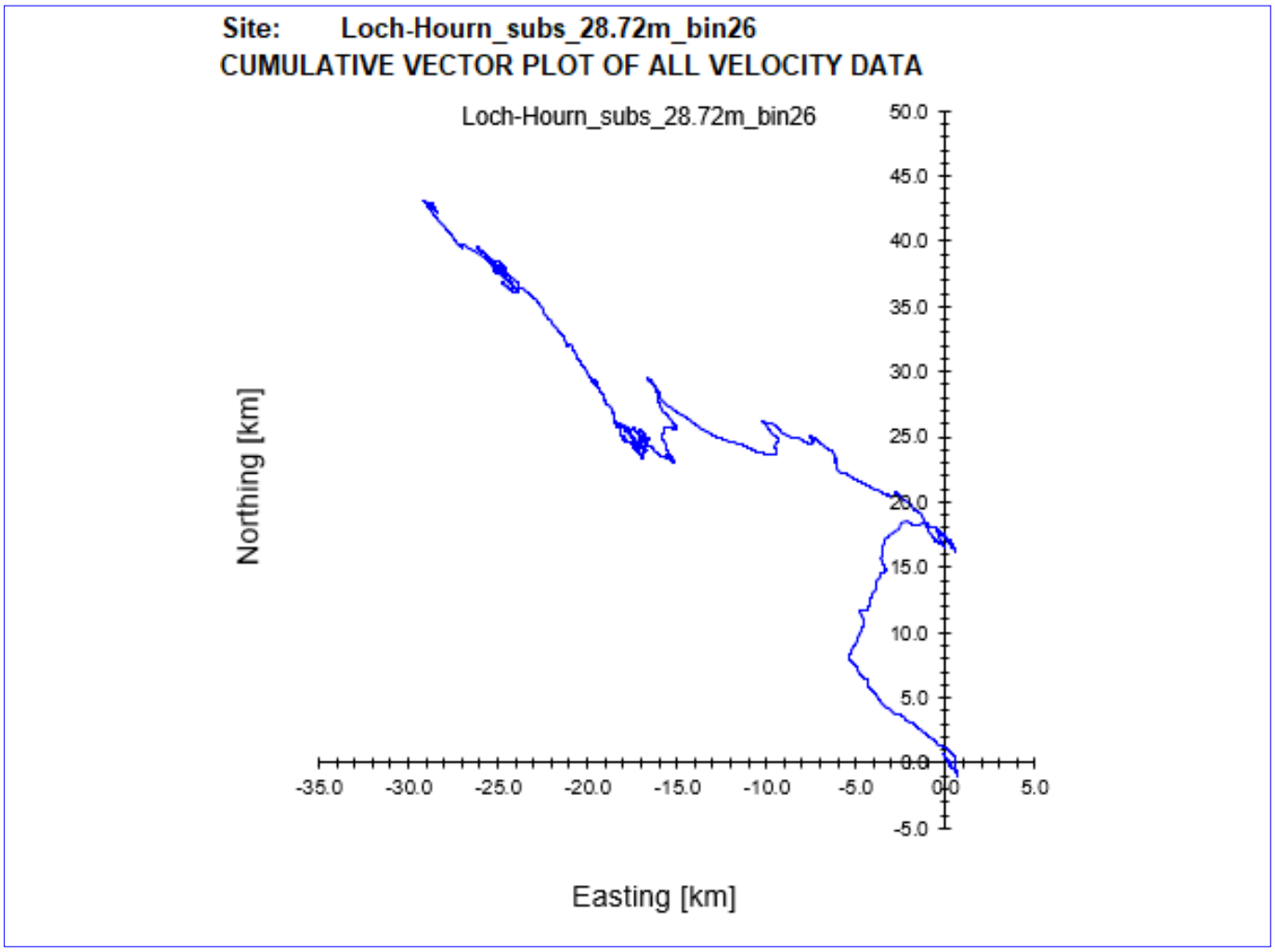


Figure 7. Cumulative Vector Plot of all velocity data from near surface cell for ID254.

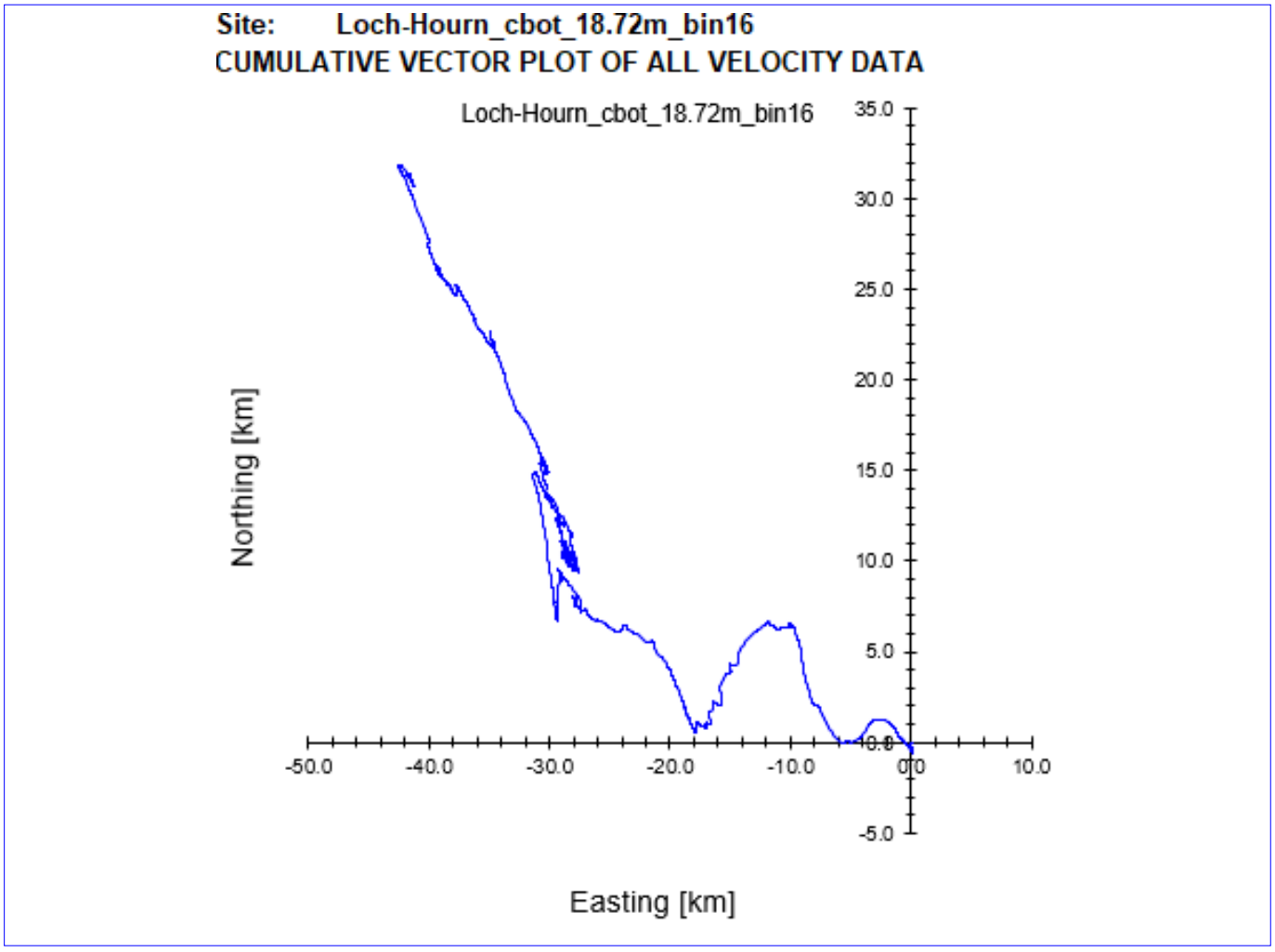


Figure 8. Cumulative Vector Plot of all velocity data from cage bottom cell for ID254.

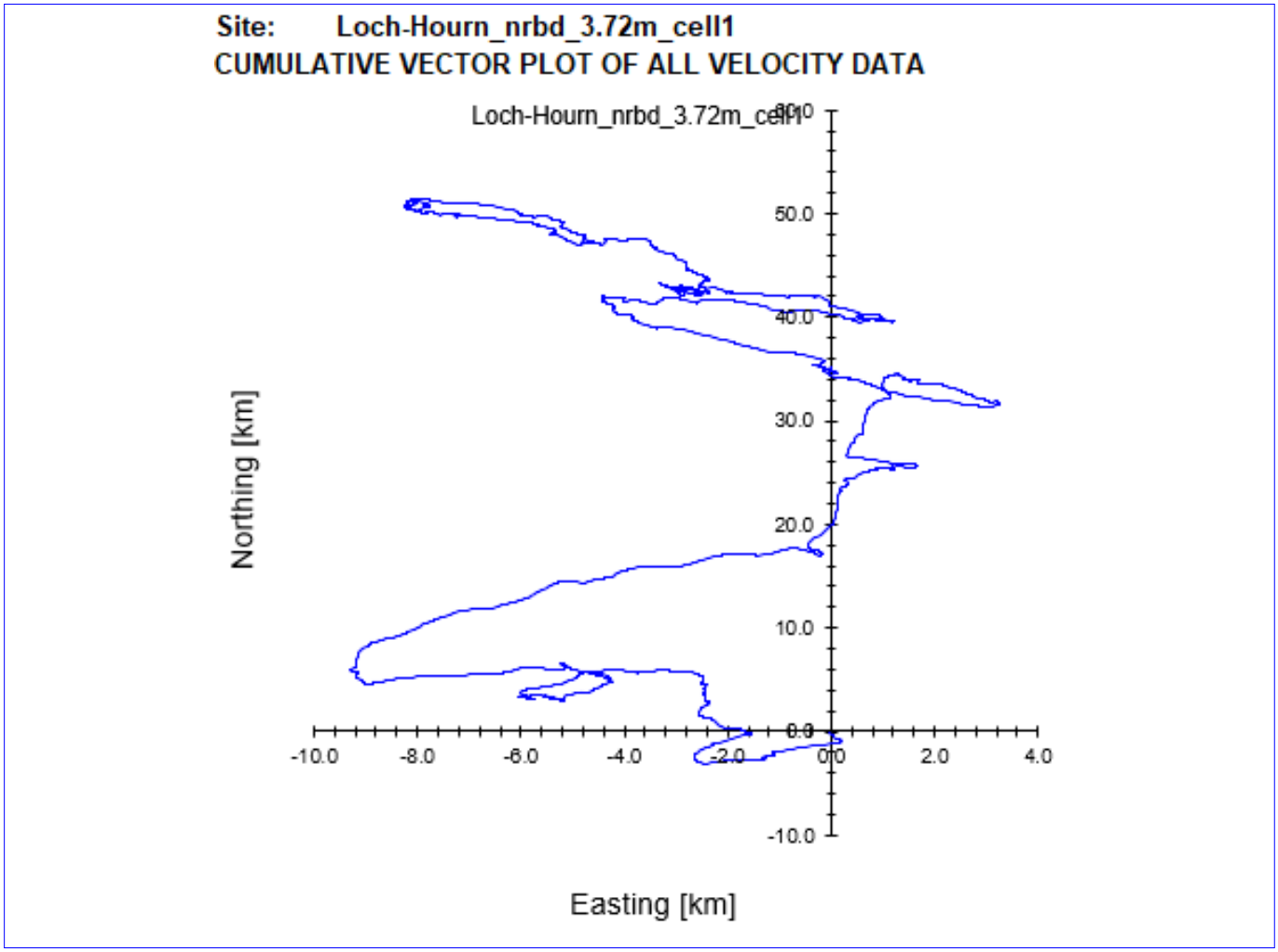


Figure 9. Cumulative Vector Plot of all velocity data from near bottom cell for ID254.

5. Summary of Current Data – ID254

Site Name: Loch Hourn
Data start date: 29/11/2018 **Data end date:** 11/01/2019
Water Depth (mean derived from pressure sensor): 36.76m

Table 2. Summary of current meter deployment

	Cell	Depth Below Surface (m)	Distance from Seabed (m)	Mean current speed (cm/s)
Near surface	26	5.78	28.72	5.68
Cage bottom	16	15.78	18.72	4.25
Near bed	1	30.78	3.72	4.07
			Average current speed:	

Table 3. Ranked percentiles for current speed at all three depths

Cell	Ranked Percentile (%) for mean speed	≤3cm/s (%)	≥4.5cm/s (%)	≥9.5cm/s (%)
Near surface	57	36	40	4
Cage bottom	58	43	33	3
Near bed	59	39	35	4

Cell	Major Axis (Deg-G)
Near surface	330
Cage Bottom	330
Near bed	360

Table 4. Mean and residual currents

	Mean Speed (m/s)	Residual Speed (m/s)	Residual Parallel (m/s)	Residual Normal (m/s)	Tidal Amplitude Parallel (m/s)	Tidal Amplitude Normal (m/s)
Near Surface	0.043	0.014	0.014	-0.001	0.061	0.033
Cage Bottom	0.039	0.014	0.013	-0.005	0.053	0.029
Near Bed	0.042	0.013	0.013	-0.001	0.057	0.037

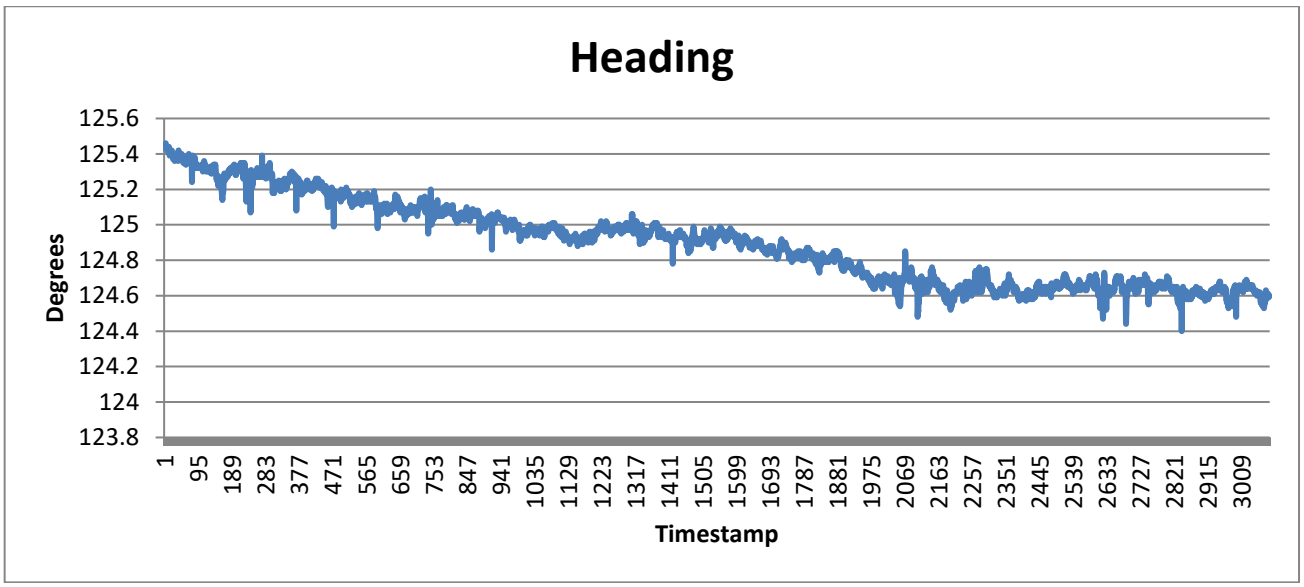


Figure 10. Summary of heading data from deployment ID254.

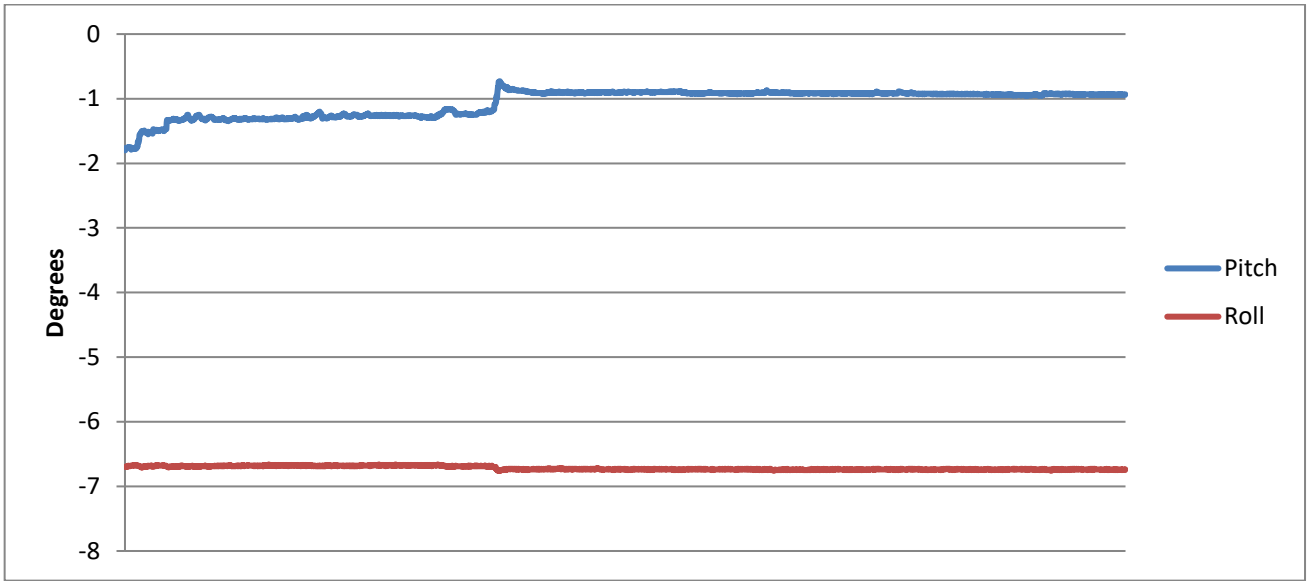


Figure 11. Summary of pitch and roll data from deployment ID254.

6. Conclusion

MOWI has collected and analysed current and bathymetric data for the proposed technical variation at the Loch Hourn fish farm. The analysed current data for the 42 days and 22 hours period are believed to be reliable and representative of the proposed location. The local-area bathymetric data gained from surveying the site, combined with the wider-area UKHO bathymetry data, provided a coherent bathymetric dataset for the site.

Annex 1. Survey Equipment Deployment Log

Sentinel V (ADCP) Current Meter Record Log
Location: Loch Hourn
Nearest tidal port: Loch Hourn Time zone: UTC

Deployment Details:

	Time		Date
Meter switched on.	14:00:00		29/11/2018
Meter deployed.	14:00:00		29/11/2018
Meter lifted.	12:20:00		14/02/2019
Meter switched off.	12:20:00		14/02/2019
Period used for this report.	29/11/2018 14:00:00	to	11/01/2019 11:40:00

ADCP serial number: 106
Meter position: 57.12582N, -5.63783W
179909E 809751N
Minimum water depth: 34.5m (33.8m measured by ADCP + 0.7m *)
Water depth (Chart Datum): 33.6m (minimum water depth - 0.9 m tide timetable)
Mean water depth: 36.76m (measured by ADCP + 0.7m *)
Depth of meter from surface: 34.96m (below mean low water spring to transducer)
Depth of meter from seabed: * Meter on seabed 0.7m to transducer head
Sounding at deployment: 35.4m @ 11:59 on 29/11/2018

ADCP meter settings:

Reference	Transducer
Bin size	1.0m
Dist to 1st bin	3.02
Number of bins	59
Frequency	307 kHz
Recording interval	20 min
No. pings per ensemble	300
Magnetic correction	0
Ensemble	300
Standard Deviation	10.9 cm/s
Time/Ping	2 seconds

Loch Hourn

Hydrographic Data Report: deployment ID275

30th April to 4th July 2019

May 2021

Mowi Scotland Limited

[redacted]

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QUALITY ASSURANCE

Mowi Scotland Ltd is ISO9001 and ISO14001 accredited and all project management follows policies designed to ensure that the collection, collation and reporting of information produced in the course of our operations is done to a consistently high standard meeting the requirements of the end user.

1. Introduction

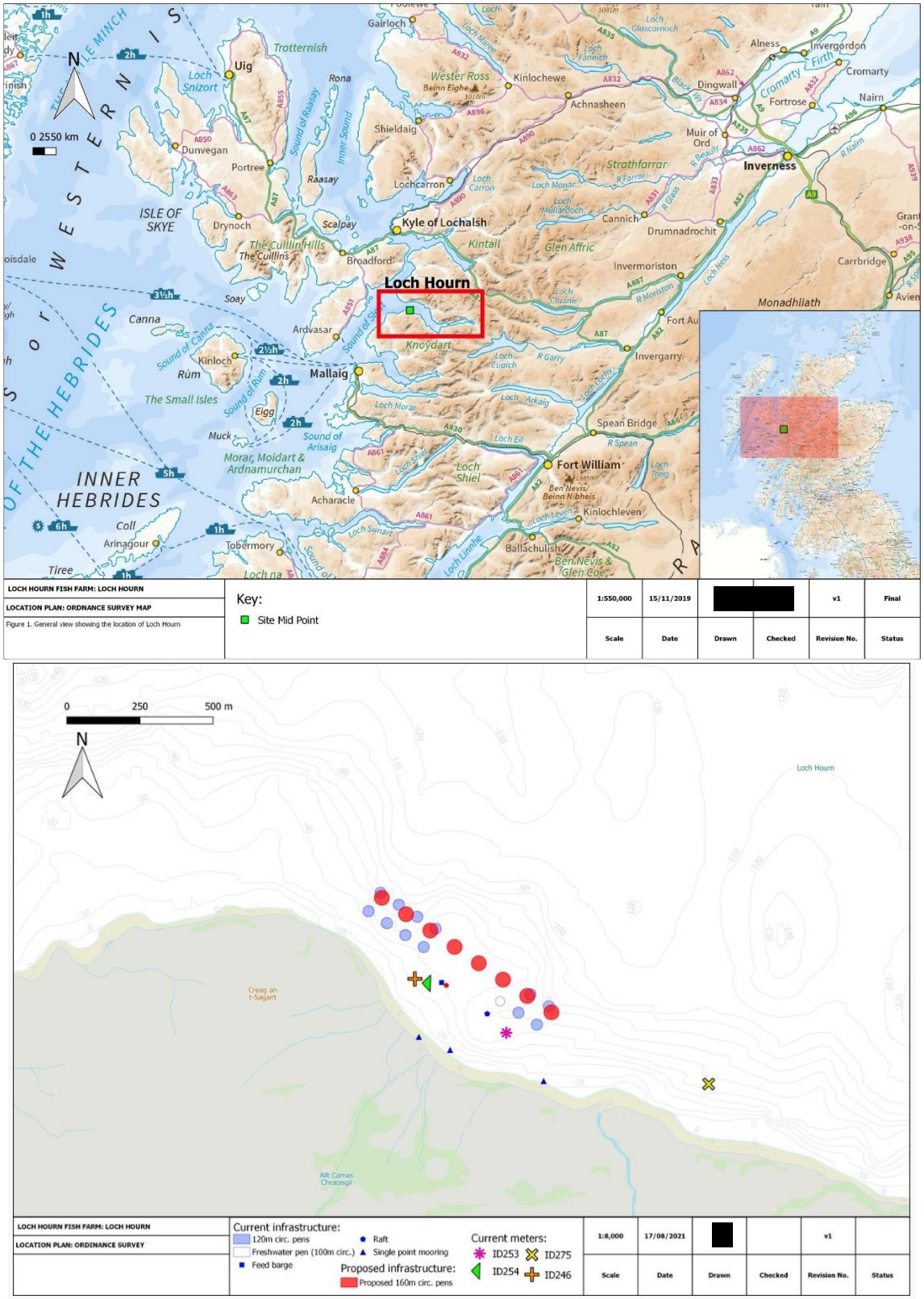


Figure 1. Site location (top) and layout (bottom) and of the salmon farm at Loch Hourn. The current meter deployment locations are marked by the cross, plus, star and triangle.

Mowi Scotland Ltd is preparing an application to the Scottish Environmental Protection Agency (SEPA) for a technical variation to CAR/L/1105276 to modify an existing salmon farm site in Loch Hourn. Mowi Scotland Ltd propose to change the existing site from 12 x 120 m circumference pens, with 16m deep nets, in a 75m

grid (Figure 1) to 8 x 160 m circumference pens with 20m deep nets which will be held in a 100m grid. An increase to the maximum standing biomass, from 2500T to 3100T, will also be applied for.

Mowi Scotland Ltd have carried out hydrographic surveys at the site between 2018 and 2019. Hydrographic data at Loch Hourn was gathered between this period in four deployments:

i. 11th September to 5th November 2018 (ID246)
ii. 29th November to 10th January 2019 (ID253)
iii. 29th November to 11th January 2019 (ID254)
iv. 30th April to 4th July 2019 (ID275)

This report describes the data from the 30th April to 4th July 2019 deployment at Loch Hourn. The purpose of this report is to assess the suitability of the collected hydrographic data for input into a hydrodynamic model of the Loch Hourn region and into the NewDepomod model.

2. Materials & Methods

2.1 Depth Survey

Bathymetry for the study area was supplemented by local area bathymetry surveys, and other data sources e.g. the UKHO INSPIRE bathymetry data (http://aws2.caris.com/ukho/mapViewer/map.action). These data were merged into a single dataset and used to provide water depths in the local area (Figure 2).

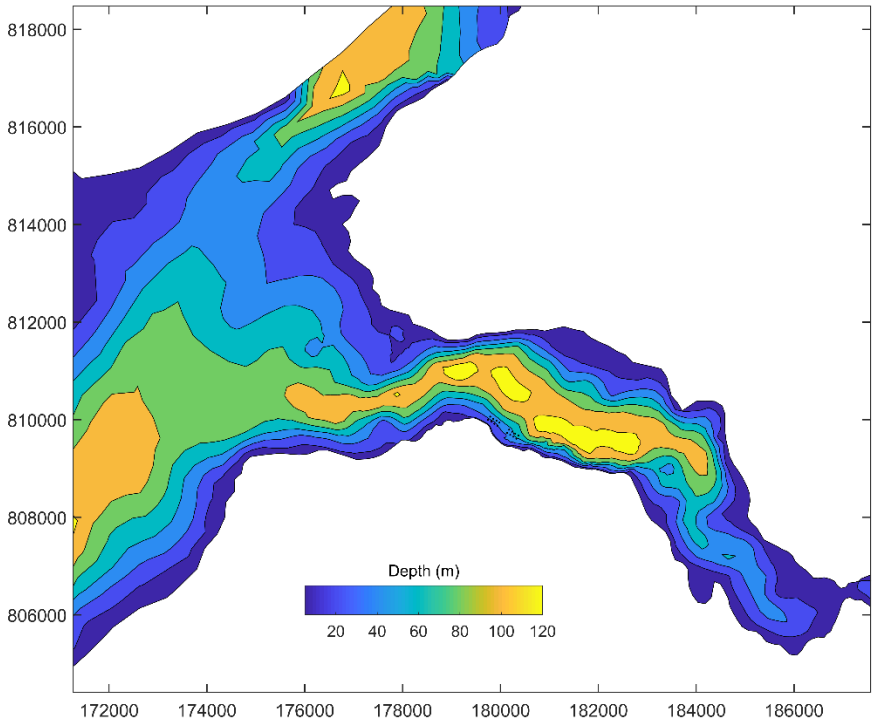


Figure 2. Bathymetry in the region of Loch Hourn.

2.2 Current Data

Mowi staff carried out hydrographic surveys at the site during 2018 – 2019. The purpose of this hydrographic report is to assess the suitability of the collected hydrographic data for use with the NewDepomod model. The data contained in this report were recorded at the site from 30th April to 4th July 2019 (64 days and 16 hours of data; deployment ID275). The data from the other three deployments (ID246, ID253 and ID254) are

presented in separate hydrographic reports. In addition to current data, bathymetry data were also collected to support these reports.

The Sentinel V100 (Wide) ADCP (Table 1), within its mooring frame, was positioned at 57° 07.557'N, 005° 38.272'W (179906.96E 809768.88N), which was approximately 190m from the nearest shoreline and approximately 950m from the centre of the proposed cage group (Figure 1). The transducer head was 70 cm from the base of the mooring frame. The mean depth (derived from the pressure sensor) at the Sentinel V100 ADCP position was 60.42 m.

Initial soundings were taken to establish the possible depth the Sentinel V100 ADCP would be situated at during high tide and so that the most appropriate cell size could be determined. The cell size was set at 1.0 m and the number of cells to 79.

Data was automatically written and stored to the internal memory within the Sentinel V100 ADCP main body and then downloaded to computer after completion of the deployment period via WiFi.

2.3 Magnetic Variation

No magnetic variation correction was made to the Sentinel V100 ADCP during deployment, this was undertaken to the data after the instrument was recovered and data downloaded. The magnetic variation used was 3.24°; this was determined using the World Magnetic Model, produced jointly with the US National Oceanographic and Atmospheric Administration's National Geophysical Data center. Further details can be found at http://www.geomag.bgs.ac.uk/navigation.html

2.4 Data Processing

Upon retrieval of the Sentinel V100 ADCP current meter, all data was downloaded to a computer for analysis. The raw data file was opened in Teledyne's "Velocity" software and Matlab. Deployment diagnostic data (beam intensity, correlation, pitch and roll) were analysed to confirm that the deployment was successful with the instrument orientated upright. The heading data were also examined to identify any movement of the Sentinel V100 ADCP mooring frame during the deployment.

The diagnostic data suggested that velocities from the first 48 bins were valid (Figure 3). Calculations were undertaken to identify the cells to be used for surface and middle currents. Surface data was taken at an average depth (derived from the pressure sensor) of 7.34 m (cell 48), and cage-bottom data at 15.34 m (cell 40). Surface and middle cell heights were 50.71 m and 42.71 m from the seabed respectively. The bottom cell (cell 1) was at a depth of 54.34 m and 3.71 m above the seabed.

Table 1: Sentinel V100 ADCP Specifications.

Depth Cell Size[1]		**V20 (1000kHz)**		**V50 (500kHz)**		**V100 (300kHz)**	
	Depth Cell Size[1]	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow	Range (m)[2,3] Wide/Narrow	Std Dev (cm/s)[3,4] Wide/Narrow
	0.25m	18.0/22.6	19.2/36.5				
	0.3m	19.3/24.0	11.1/20.8				
	0.5m	20.2/24.9	7.1/13.4	44.1/57.6	19.2/36.5		
	1.0m	22.1/26.9	3.6/6.7	50.5/64.6	7.1/13.5	94.5/120.6	10.9/20.6
	2.0m	24.5/29.4	1.7/3.2	56.0/70.6	3.6/6.7	103.5/130.4	5.5/10.3
	4.0m	26.9/32.0	0.8/1.6	63.1/78.2	1.7/3.2	114.6/142.3	2.7/5.2
	6.0m			67.4/82.8	1.1/2.1	121.7/151.5	1.8/3.3
Communications and Recording	Wireless	802.11b/g/n					
	Internal memory	One 16GB Micro SD Card included					
Profile Parameters	Velocity accuracy	V20/V50: 0.3% of the water velocity relative to the ADCP ±0.3cm/s V100: 0.5% of the water velocity relative to the ADCP ±0.5cm/s					
	Velocity resolution	0.1cm/s					
	Velocity range	±5m/s (default); ±20m/s (maximum)					
	Ping rate	Up to 4Hz					
Echo Intensity Profile	Vertical resolution	Depth cell size					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	25°					
	Configuration	4-beam, convex; 5th beam vertical					
	Depth rating	200m					
	Materials	Transducer, housing, and end cap: plastic Connector: metal shell					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, precision ±0.4°C, resolution 0.1°					
	Compass (magneto-inductive sensor)	Accuracy 2° RMS, resolution 0.1°, max. dip angle 85°					
	Tilt (MEMS accelerometers)	Pitch range ±90°, roll range ±180°, accuracy 2° RMS, precision 0.05° RMS, resolution 0.1°					
	Pressure sensor (mounted on transducer)	Range 300m, accuracy 0.1%FS					
Power	External DC input	12–20VDC					
	Internal battery voltage	18VDC new					
	Battery capacity; over-the-counter @0°C	100 watt hours (typical)					
	Battery pack @5°C	510 watt hours					
Software	Teledyne RDI's new software included	ReadyV—Pre-deployment (testing, planning, and data recovery)[5] Velocity—Post-processing (data handling, display, and export)[6]					
Environmental	Standard depth rating	200m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	7.5kg – 16.0kg					
	Weight in water	1.6kg – 6.0kg					
Available Options	External battery case • AC/DC power converter • 5th beam (at time of order only) • Waves processing • Straight or right-angle metal shell connector						
Dimensions	Special configuration drawing available upon request						

1 User's choice of depth cell not limited to the typical values specified.
2 Ranges specified are typical at temperature of 5°C and salinity of 35psu; longer ranges are possible.
3 User selects the bandwidth mode; wide = 25% or narrow = 6%.
4 Standard deviations (Std Dev) are typical values for single ping data
5 Resident in ADCP accessed via a web browser.
6 Windows™ based software program.

Specifications subject to change without

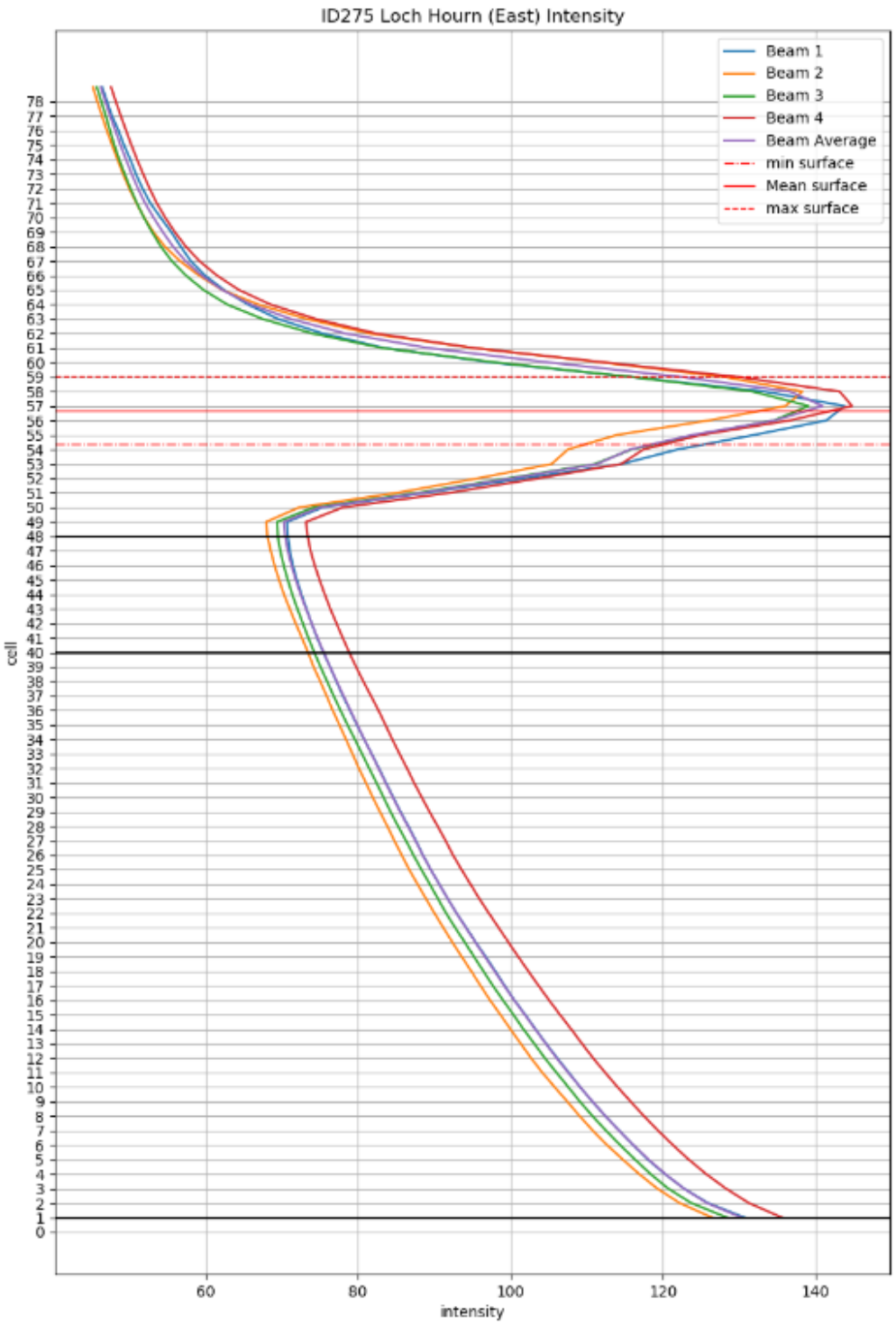


Figure 3. Mean intensity of the ADCP signal for the ID275 dataset plotted by bin number

The 'first cell range' is automatically calculated by the instrument, which is the distance from the transducer head to the first cell. For this deployment, the first cell range was calculated as 3.01 m. This value is then added to the height of the instrument frame (0.7 m) to get the first cell height above the seabed, which equated to 3.71 m.

Standard deviation has been assessed throughout the deployment to identify accurate and reliable data for near bed, middle (net depth) and surface cells using the following equation:

$$Cell\ StdDev = \frac{Instrument\ StdDev}{\sqrt{No.valid\ pings}} \qquad (1)$$

The Instrument Standard Deviation (StdDev) in Equation 1 is determined using the deployment settings when the meter is programmed, examples of the StdDev values for different configurations are shown in Table 1. This deployment had a cell size of 1m which equates to an Instrument StdDev of 10.9 cm/s.

The Percentage of valid pings used to calculate Cell StdDev is derived using "Percentage Good" data which allows us to relate the StdDev to the actual data gathered. The percent good data is available for 1, 2, 3 and 4 beams which represent the following:

- Percent good 1 = % of good data computed from 3 Beams
- Percent good 2 = % of bad data due to more than 2 Beam bad
- Percent good 3 = % of bad data due to error velocity exceeded
- Percent good 4 = % of good data computed from 4 Beams

The method described has been used to calculate the Standard deviation throughout the deployment for the surface, middle and bottom cells; the average StdDev values for the surface middle and bottom was 0.63cm/s, 0.63cm/s and 0.63cm/s respectively which are all within the SEPA criteria of 2cm/s.

2.5 Meteorological Data

The collection of meteorological data is no longer required to support the assessment process and consequently has not been undertaken. The current data used is collected using mulitple deployments and over a longer period and thus provides a more realistic representation of site conditions than short deployments, thus allowing an assessment of the influence of meterological conditions.

3. Results and Discussion

A summary of the current data is shown in Figure 4 to Figure 11 and in Table 2 to Table 4. Over the period analysed for this report, the near-surface, middle and bottom cells had current speed averages of 4.25 cm/s, 3.39 cm/s and 2.19 cm/s respectively. This gave an overall average of 3.27 cm/s. The orientation of the tidal velocities was northwest, southeast.

Residual currents at the surface and mid-depth were toward the north-west (277°G and 272°G respectively); near the seabed, the residual flows during the deployment period were to the southeast (116°G, Figure 9). The magnitude of the residual currents for the surface, middle and bottom cells were moderate, with mean values of 0.018 m/s, 0.009 m/s and 0.004 m/s respectively.

4. Hydrographic Data Summary Sheets

Current meter ID :	Loch-Hourn_subs_50.7m_bin48			180912mE	809409mN
declination:	-3.240		convergence: -3.040	GMA:	-0.2 (Deg-G)
Period of measurement :	30/4/19 16:00	to	4/7/19 09:00	64 days	17 hrs	0 mins

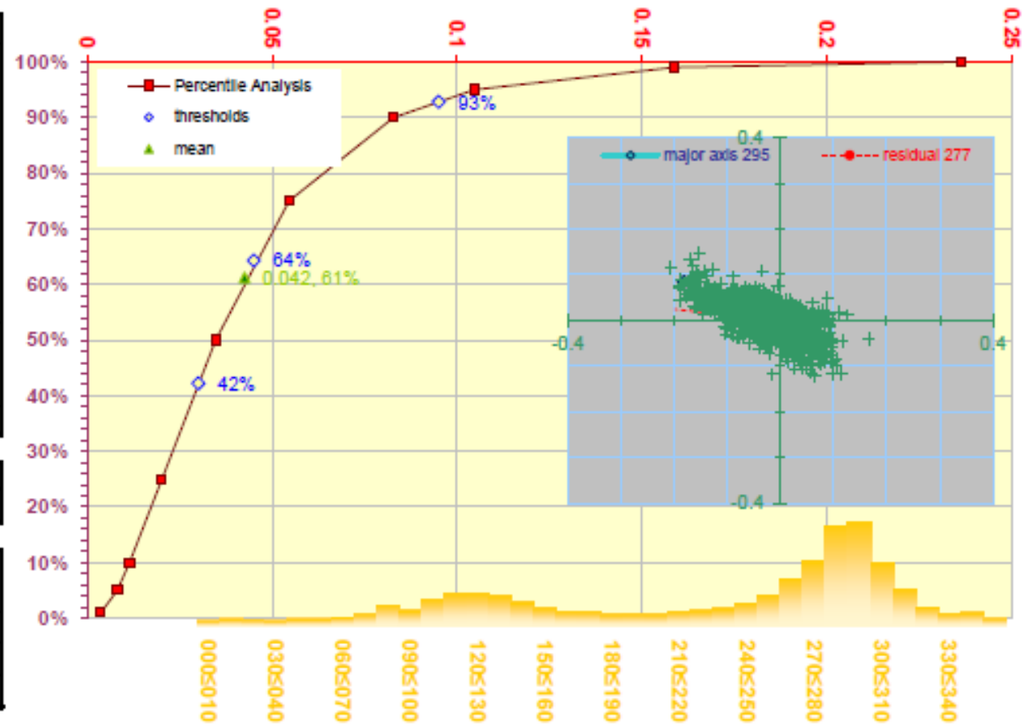
Depth/ Pressure	Max:	12.02
	Mean:	9.71
	Min:	7.34

Percentiles	Current Speed	
1%	0.004 m/s	percentile analysis
5%	0.008 m/s	
10%	0.011 m/s	
25%	0.020 m/s	
50%	0.035 m/s	
75%	0.055 m/s	
90%	0.083 m/s	
95%	0.105 m/s	
99%	0.159 m/s	
100%	0.236 m/s	
42%	0.030 m/s	threshold values
64%	0.045 m/s	
93%	0.095 m/s	
61%	0.042 m/s	mean

Major axis :	295 (Deg-G)		0.066 m/s
Residual current :	0.018 m/s	at	277 (Deg-G)

	Residual	Tidal amplitude
Longitudinal (U) :	0.017 m/s	0.066 m/s
Lateral (V) :	-0.006 m/s	0.025 m/s
Anisotropy (long'l/lat'l) :	3.07	2.67

x	y
major axis 295	
-0.181	0.0845
-0.06	0.0279
0	0
######	######
residual 277	
0	0
-0.018	0.0022
-0.199	0.0242



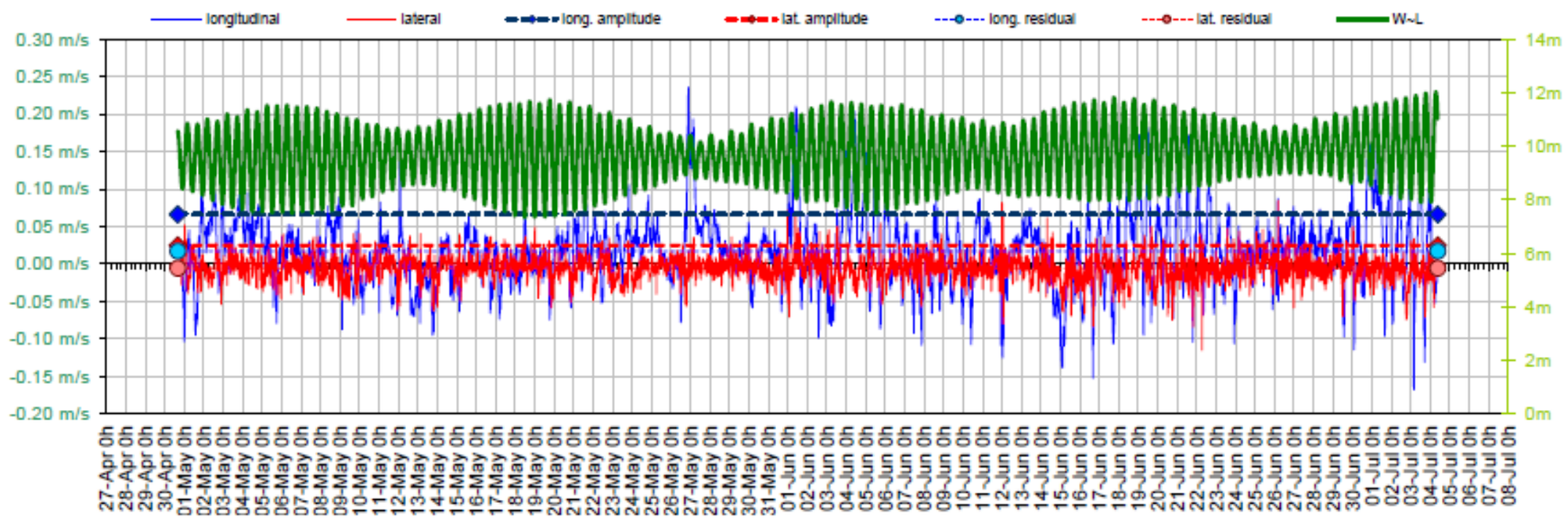


Figure 4. Current Data Summary Sheet for the surface current cell 48, 50.7m from seabed, 30th April to 4th July 2019 inclusive (ID275).

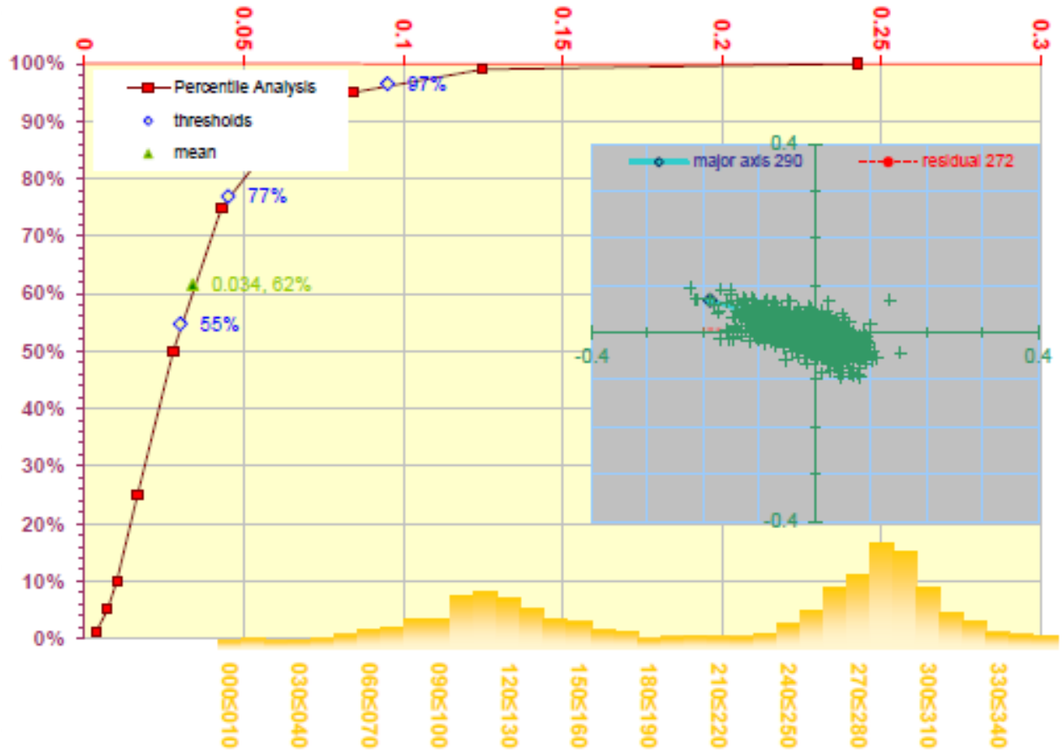
Current meter ID :	Loch-Hourn_cbot_42.7m_bin40			180912mE	809409mN
declination:	-3.240		convergence: -3.040	GMA:	-0.2 (Deg-G)
Period of measurement :	30/4/19 16:00	to	4/7/19 09:00	64 days	17 hrs	0 mins

Depth/ Pressure	Max:	20.02
	Mean:	17.71
	Min:	15.34

Percentiles	Current Speed	
1%	0.003 m/s	percentile analysis
5%	0.007 m/s	
10%	0.010 m/s	
25%	0.017 m/s	
50%	0.028 m/s	
75%	0.043 m/s	
90%	0.064 m/s	
95%	0.084 m/s	
99%	0.125 m/s	
100%	0.243 m/s	
55%	0.030 m/s	threshold values
77%	0.045 m/s	
97%	0.095 m/s	
62%	0.034 m/s	mean

Major axis :	290 (Deg-G)		0.055 m/s
Residual current :	0.009 m/s	at	272 (Deg-G)

	Residual	Tidal amplitude
Longitudinal (U) :	0.008 m/s	0.055 m/s
Lateral (V) :	-0.003 m/s	0.021 m/s
Anisotropy (long'l/lat'l) :	3.11	2.63



x	y
major axis 290	
-0.188	0.0684
-0.052	0.0187
0	0
######	######
residual 272	
0	0
-0.009	0.0003
-0.2	0.0076

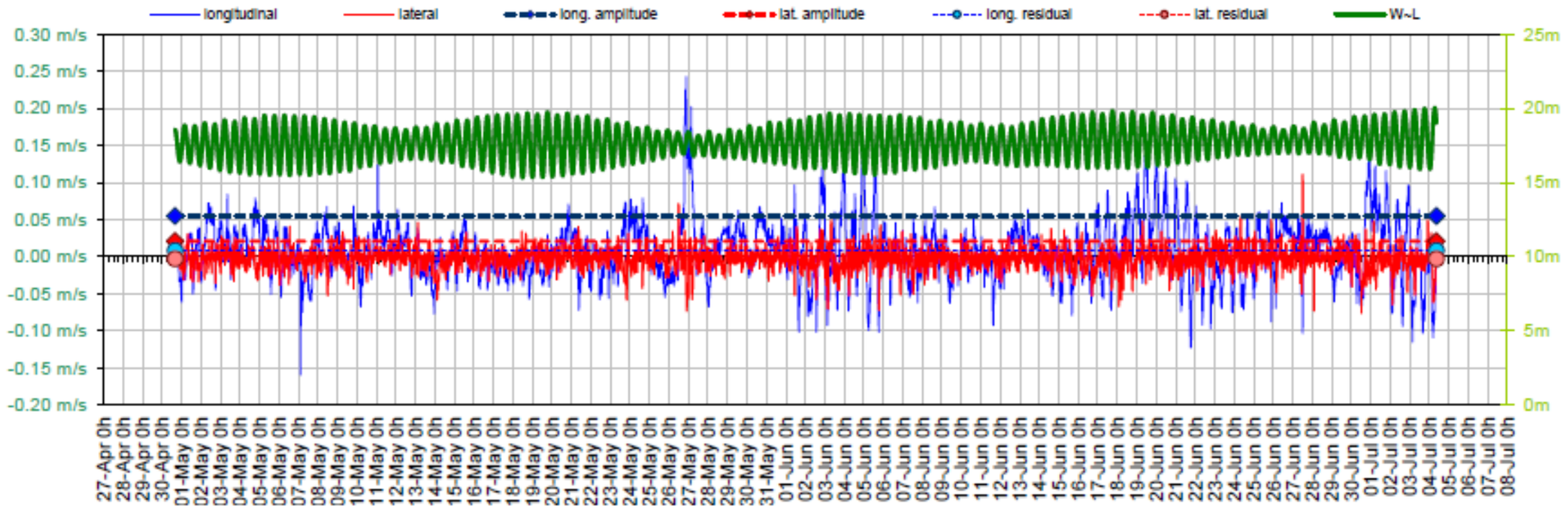


Figure 5. Current Data Summary Sheet for the cage bottom current cell 40, 42.7m from seabed, 30th April to 4th July 2019 inclusive (ID275).

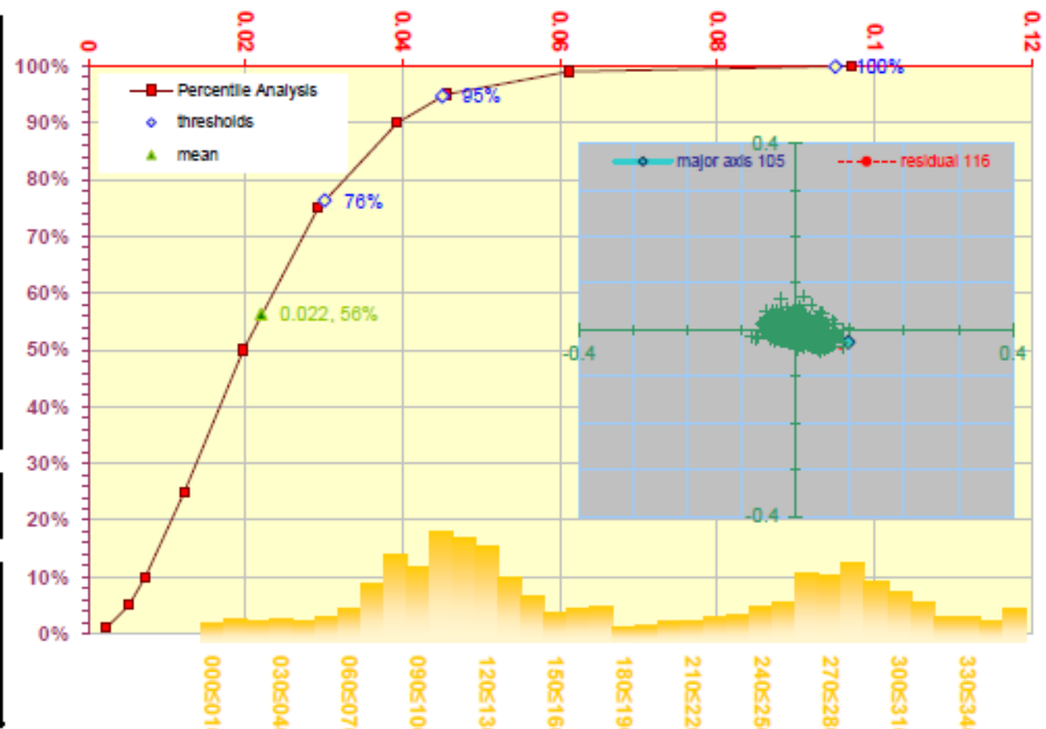
Current meter ID :	Loch-Hourn_nrbd_3.7m_bin01			180912mE	809409mN
declination:	-3.240		convergence:	-3.040	GMA: -0.2 (Deg-G)
Period of measurement :	30/4/19 16:00	to	4/7/19 09:00	64 days	17 hrs 0 mins

Depth/ Pressure		
	Max:	59.02
	Mean:	56.71
	Min:	54.34

Percentiles	Current Speed	
1%	0.002 m/s	percentile analysis
5%	0.005 m/s	
10%	0.007 m/s	
25%	0.012 m/s	
50%	0.020 m/s	
75%	0.029 m/s	
90%	0.039 m/s	
95%	0.045 m/s	
99%	0.061 m/s	
100%	0.097 m/s	
76%	0.030 m/s	threshold values
95%	0.045 m/s	
100%	0.095 m/s	
56%	0.022 m/s	mean

Major axis :	105 (Deg-G)		0.032 m/s
Residual current :	0.004 m/s	at	116 (Deg-G)

	Residual	Tidal amplitude
Longitudinal (U) :	0.004 m/s	0.032 m/s
Lateral (V) :	0.001 m/s	0.016 m/s
Anisotropy (long'l/lat'l) :	5.12	2.04



x	y
major axis 105	
0.0966	-0.026
0.0308	-0.008
0	0
######	######
residual 116	
0	0
0.0037	-0.002
0.0898	-0.044

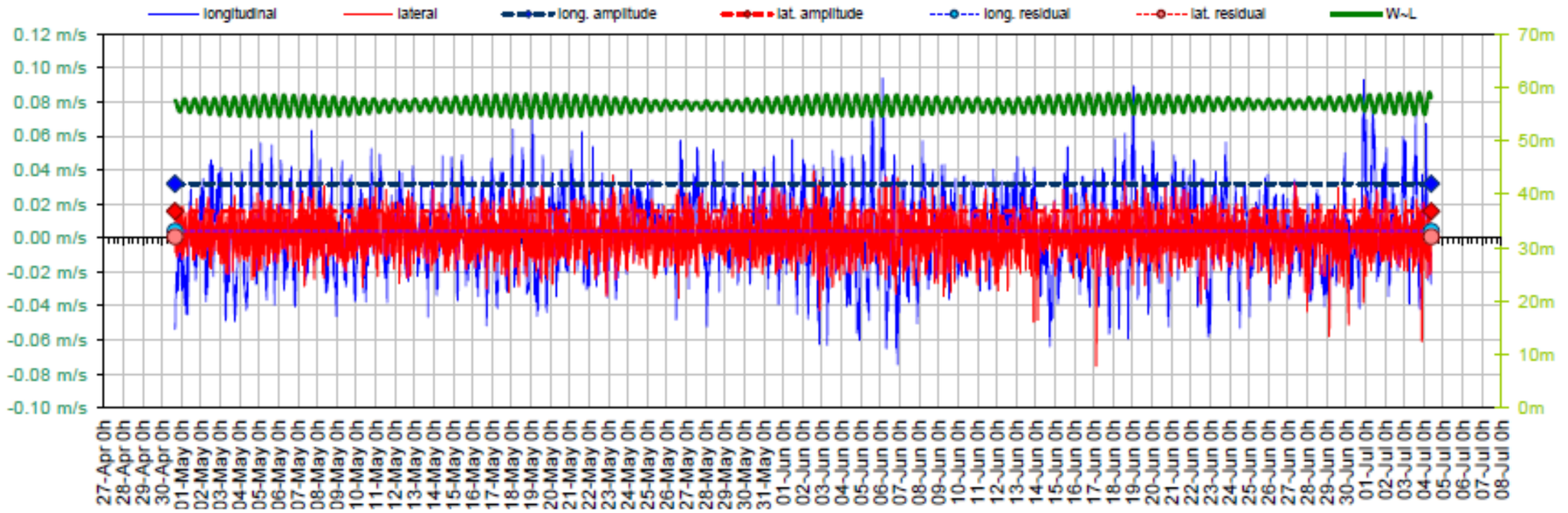


Figure 6. Current Data Summary Sheet for the near bottom current cell 1, 3.7m from seabed, 30th April to 4th July 2019 inclusive (ID275).

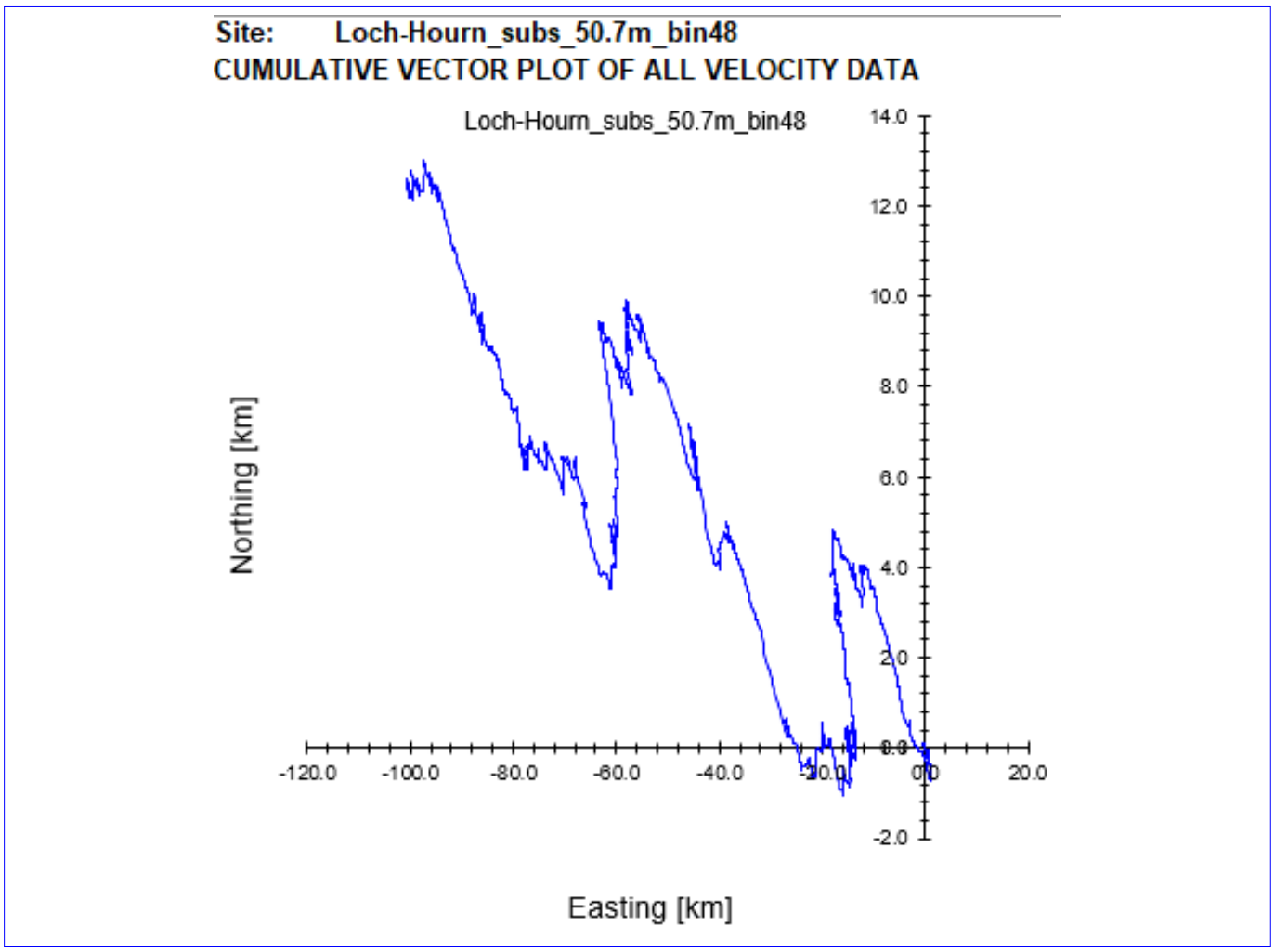


Figure 7. Cumulative Vector Plot of all velocity data from near surface cell for ID275.

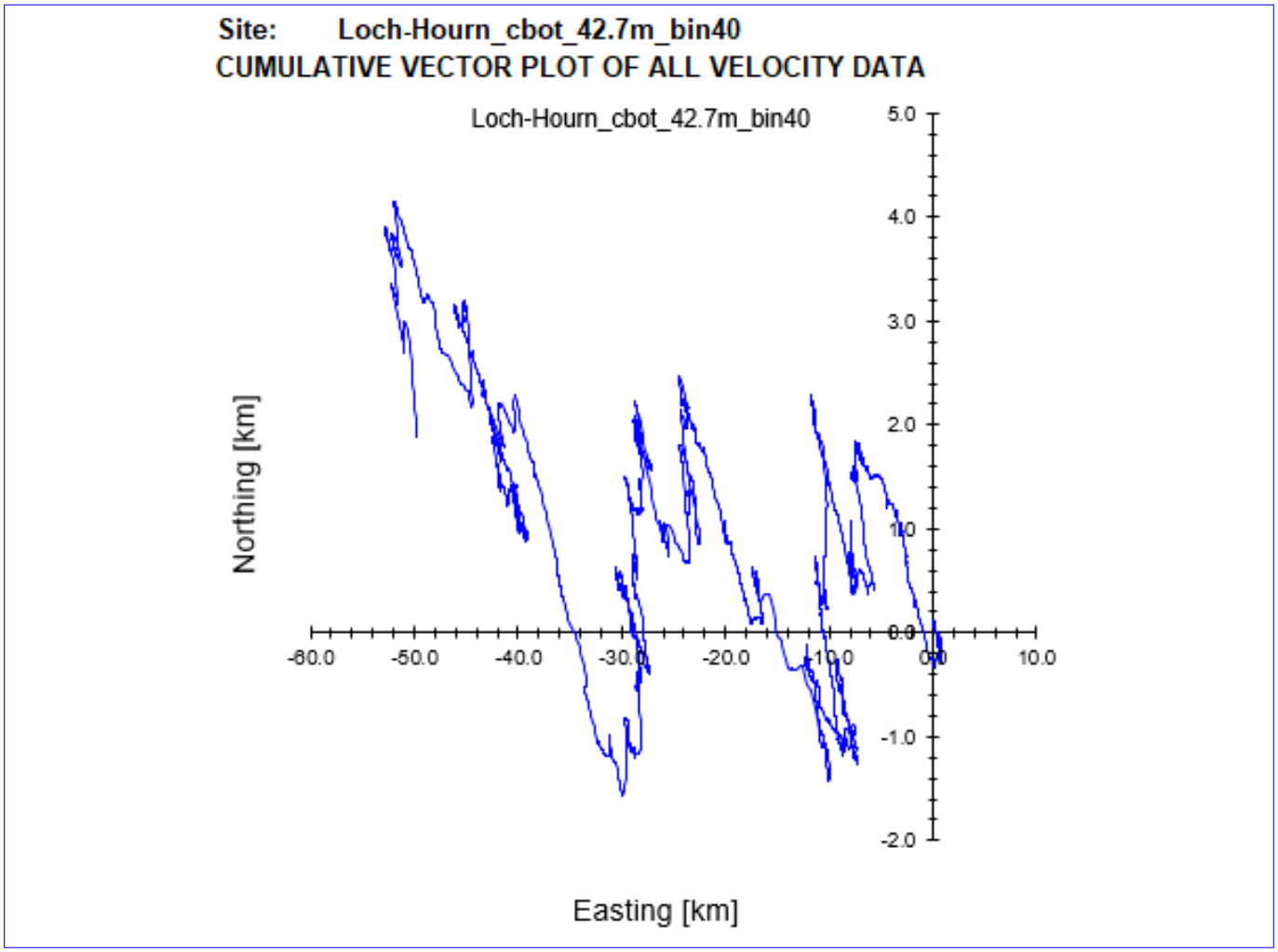


Figure 8. Cumulative Vector Plot of all velocity data from cage bottom cell for ID275.

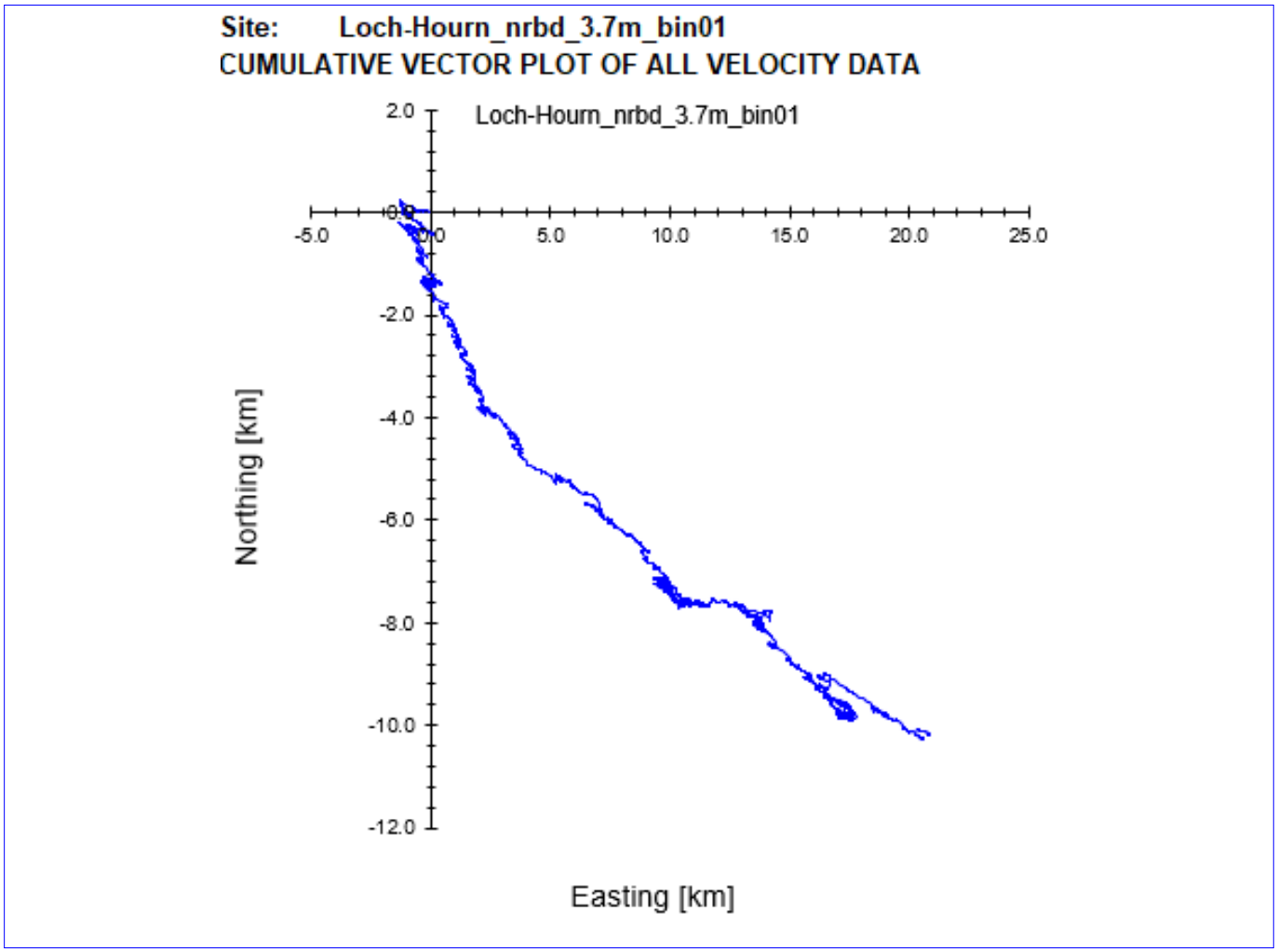


Figure 9. Cumulative Vector Plot of all velocity data from near bottom cell for ID275.

5. Summary of Current Data – ID275

Site Name: Loch Hourn
Data start date: 30/04/2019 **Data end date:** 04/07/2019
Water Depth (mean derived from pressure sensor): 60.42m

Table 2. Summary of current meter deployment

	Cell	Depth Below Surface (m)	Distance from Seabed (m)	Mean current speed (cm/s)
Near surface	48	7.34	50.71	4.25
Cage bottom	40	15.34	42.71	3.39
Near bed	1	54.34	3.71	2.19
			Average current speed:	3.28

Table 3. Ranked percentiles for current speed at all three depths

Cell	Ranked Percentile (%) for mean speed	≤3cm/s (%)	≥4.5cm/s (%)	≥9.5cm/s (%)
Near surface	61	42	36	7
Cage bottom	62	55	23	3
Near bed	56	76	5	0

Cell	Major Axis (Deg-G)
Near surface	295
Cage Bottom	290
Near bed	105

Table 4. Mean and residual currents

	Mean Speed (m/s)	Residual Speed (m/s)	Residual Parallel (m/s)	Residual Normal (m/s)	Tidal Amplitude Parallel (m/s)	Tidal Amplitude Normal (m/s)
Near Surface	0.042	0.018	0.017	-0.006	0.066	0.025
Cage Bottom	0.034	0.009	0.008	-0.003	0.055	0.021
Near Bed	0.022	0.004	0.004	0.001	0.032	0.016

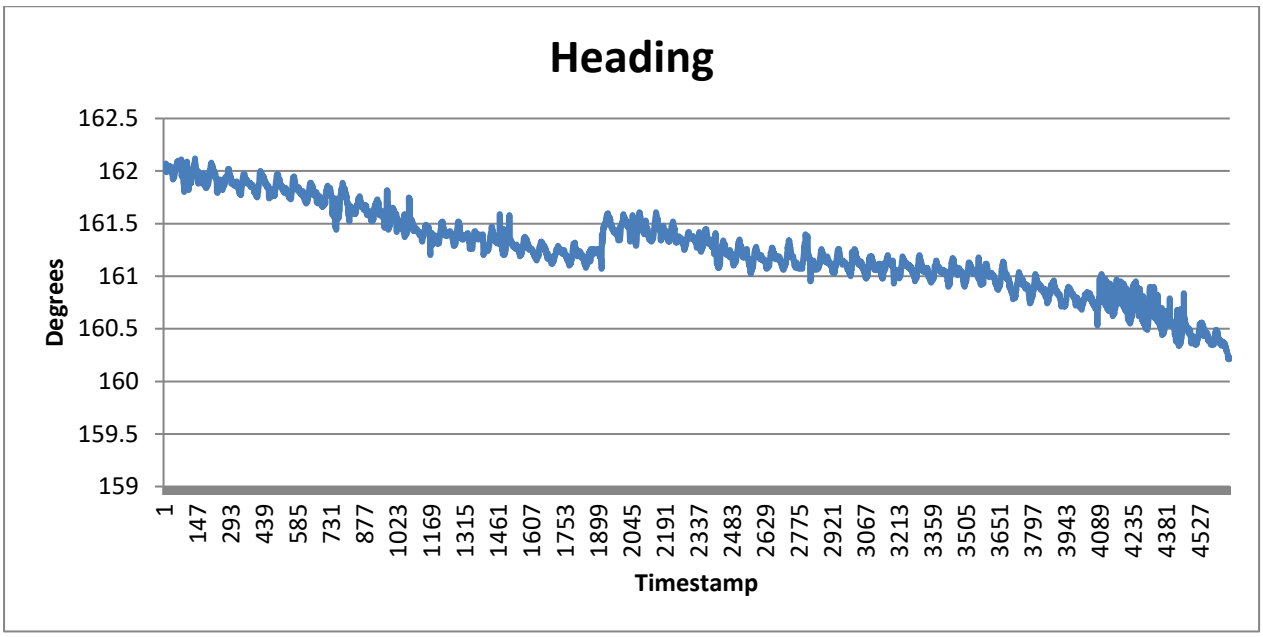


Figure 10. Summary of heading data from deployment ID275.

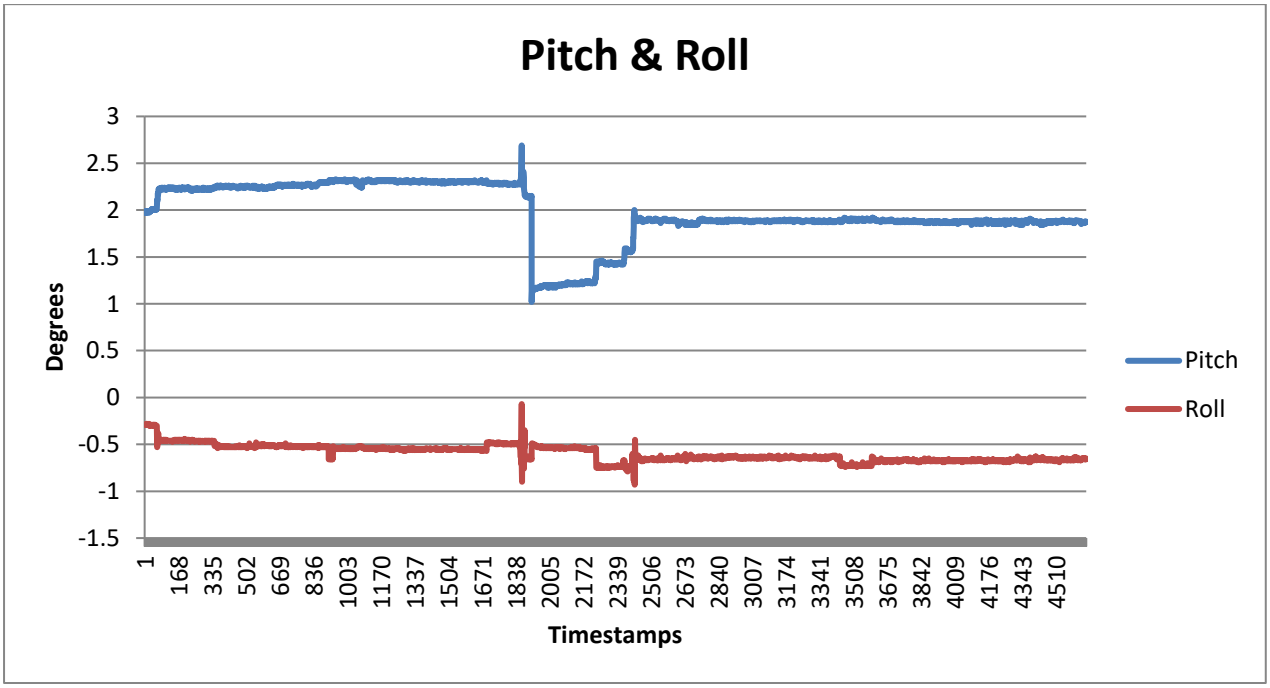


Figure 11. Summary of pitch and roll data from deployment ID275.

6. Conclusion

MOWI has collected and analysed current and bathymetric data for the proposed technical variation at the Loch Hourn fish farm. The analysed current data for the 64 days and 16 hours period are believed to be reliable and representative of the proposed location. The local-area bathymetric data gained from surveying the proposed site, combined with the wider-area UKHO bathymetry data, provided a coherent bathymetric dataset for the site.

Annex 1. Survey Equipment Deployment Log

Sentinel V (ADCP) Current Meter Record Log

Location: Loch Hourn

Nearest tidal port: Loch Hourn Time zone: UTC

Deployment Details

	Time		Date
Meter switched on.	16:00:00		30/04/2019
Meter deployed.	16:00:00		30/04/2019
Meter lifted.	09:40:00		04/07/2019
Meter switched off.	09:40:00		04/07/2019
Period used for this report.	30/04/2019 16:00:00	to	04/07/2019 09:00:00

ADCP serial number: 24356

Meter position: 57° 07.24’N, 005° 37.16'W

180912E 809409N

Minimum water depth: 58.05m (57.35m measured by ADCP + 0.7m *)

Water depth (Chart Datum): 57.35m (minimum water depth - 0.7 m tide timetable)

Mean water depth: 60.42m (measured by ADCP + 0.7m *)

Depth of meter from surface: 57.35m (below mean low water spring to transducer)

Depth of meter from seabed: * Meter on seabed 0.7m to transducer head

Sounding at deployment: 58.7m @ 16:00 on 30/04/2019

Data summary:

	Cell number	Depth (m)	Dist from seabed (m)	Mean current speed (cm/s)
Surface	Cell 48	7.34m Below MLWS	50.71m	4.25
Mid depth	Cell 40	15.34m Below MLWS	42.71m	3.39
Bottom	Cell 1	54.34m Below MLWS	3.71m	2.19
Average current speed:				**3.27**

ADCP meter settings:

Reference	Transducer
Bin size	1.0m
Dist to 1st bin	3.01
Number of bins	79
Frequency	307 kHz
Recording interval	20 min
No. pings per ensemble	300
Magnetic correction	0
Ensemble	300
Standard Deviation	0.63cm/sec
Time/Ping	2 seconds